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SEVERIN (H. H. P.) & DICKSON (R. C.). **Perennial-Delphinium ring spot.**—*Hilgardia*, xiv, 8, pp. 465–483, 4 pl., 4 figs., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 276, 1943.]

The host range of an undescribed ring-spot virus of perennial *Delphinium*, as determined by mechanical inoculation experiments, includes 11 species of plants in eight genera belonging to five families, viz., the Blackmore and Langdon *Delphinium* varieties, Turban and Persian buttercups (*Ranunculus asiaticus*), sugar beet, Acala cotton, Turkish and White Burley tobacco, *Nicotiana glutinosa*, *N. alata* var. *grandiflora*, *N. rustica* var. *humilis*, *Petunia hybrida* Crimson King, *Datura stramonium*, and White Spine cucumber. Infection is systemic in the cases of *Delphinium*, cotton, *P. hybrida*, *N. alata* var. *grandiflora*, and cucumber, and local in those of the other hosts, except *R. asiaticus*, a symptomless carrier; the virus was recovered from *Delphinium*, *R. asiaticus*, cotton, tobacco (only during the development of the lesions), *P. hybrida*, and cucumber. The virus was inactivated in ten minutes at 65° C., or after exposure of the extracted juice from cucumber at room temperature for five days; the tolerance to dilution of extracted juice from *Delphinium* and cucumber was 1 in 1,000.

BUCHHOLTZ (W. F.). **Influence of cultural factors on Alfalfa seedling infection by Pythium de Baryanum Hesse.**—*Res. Bull. Iowa agric. Exp. Sta.* 296, 24 pp., 3 figs., 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 277, 1943.]

Infection of lucerne by *Pythium de Baryanum*, resulting in necrosis of the germinating seed or seedlings, primary and secondary root-girdling and root-tip necrosis, with consequent retardation of growth, tended to be more prevalent in acid ($P_H < 6{\cdot}6$) than in neutral ($P_H > 6{\cdot}6$), although during the hot, dry summer of 1934, some acid soils in different parts of the State were apparently free from the pathogen. Lime, ineffectual against the fungus in laboratory experiments, produced small seedling-stand increases in the field in 1935 and still smaller ones in 1937 and 1938. Both in laboratory and field plantings seed treated with ethyl mercuric phosphate remained healthy in 1935. *P. de Baryanum* seemed to be present in greater profusion in the upper soil layers than at a depth exceeding 4 in. Deep ploughing, by turning up comparatively uninfested soil for the seed-bed, resulted in heavier seedling stands. Red, alsike, and white Dutch clovers [*Trifolium pratense*, *T. hybridum*, and *T. repens*] showed more resistance to *P. de Baryanum* in greenhouse and field plantings than lucerne. Early planting, liming [*R.A.M.*, xix, p. 328], and deep ploughing are recommended as possible control measures.

KOEPPER (J. M.). **Relative resistance of Alfalfa species and varieties to rust caused by Uromyces striatus.**—*Phytopathology*, xxxii, 12, pp. 1048–1057, 4 figs., 1942.

Lucerne rust (*Uromyces striatus*), normally regarded as one of the minor diseases, has been responsible for considerable damage of recent years, especially to the

seed crop, in parts of the central United States. At the Kansas Agricultural Experiment Station in 1940, a study of the relative resistance to the pathogen of *Medicago ruthenica*, *M. falcata*, and lucerne varieties and selections, was carried out under laboratory, greenhouse, and field conditions. In the laboratory, excised leaves, inoculated by means of a camel-hair brush with fresh uredospores, survived for three to four weeks in moist Petri dishes. In the greenhouse, uredospore suspensions were atomized on to potted plants in moist chambers, in which the relative humidity was maintained at nearly 100 per cent. for 48 hours, whereupon the plants were transferred to wet sand beds on the floor. Under greenhouse conditions *M. ruthenica* was the most resistant, and Turkestan and Hairy Peruvian the most susceptible, of the species and varieties tested. Semipalatinsk immediately followed *M. ruthenica* in resistance to *U. striatus*, while a field selection of Ladak was the most satisfactory representative of the *M. sativa* group in this respect, besides withstanding the attacks of *Ascochyta imperfecta*. Apart from Hairy Peruvian, which was fairly free from rust in the field in 1939, the laboratory and greenhouse ratings of the different varieties agreed very closely with those made out-of-doors.

Wernham (C. C.). **Epichloe typhina on imported Fescue seed.**—*Phytopathology*, xxxii, 12, p. 1093, 1942.

Of 104 selections of *Festuca rubra* [var.] *genuina* imported from Hungary in 1939 and grown at the Pennsylvania State College, 27 clones were observed in 1942 (their second season of seed production) to bear the fructifications of *Epichloe typhina* [*R.A.M.*, xxii, p. 139], reported by Miss Sampson and J. H. Western [ibid., xx, p. 471] to be transmissible through the seed to the extent of 99 per cent. In a few clones every seed stalk showed the typical symptoms of 'choke' disease, white stromata being present on the leaf sheaths and on some of the spikelets of the panicle, which often failed to emerge. In view of the risk of widespread systemic infection from this source, the diseased clones were removed from the nursery and burnt, a few severely attacked plants, however, being transferred to an isolated plot and interplanted with a healthy strain to determine the rate of dissemination of the pathogen in the field. Seed from the infected individuals was collected for the study of transmission through this channel and the effect on the fungus of hot-water treatment of the seed, but conclusive evidence from the observations is not to be expected for three years.

Cummins (G. B.). **Revisionary studies in the tropical American rusts of Panicum, Paspalum and Setaria.**—*Mycologia*, xxxiv, 6, pp. 669–695, 24 figs., 1942.

On the basis of a taxonomic study of 14 rusts occurring on grasses in the tropical and subtropical regions of North and South America, the author gives an annotated list of these species with revised descriptions and synonymy.

Thorne (D. W.), Laws (W. D.), & Wallace (A.). **Zinc relationships of some Utah soils.**—*Soil Sci.*, liv, 6, pp. 463–468, 1942.

Zinc-deficiency symptoms, expressed by the condition commonly known as little leaf or rosette, have been found to be prevalent in Utah on sweet cherries, apricots, peaches, apples, and plums, which have responded favourably to injections and sprays containing zinc salts. The trouble is usually observed on non-calcareous soils derived principally from granite, gneiss, quartzite, or related rocks, and is absent from those originating mainly from limestone. The zinc content of calcareous rocks was ascertained to be almost twice that of non-calcareous, in which, moreover, the element was more soluble than in the limestone, suggesting a comparatively rapid loss during weathering processes. The total available zinc contents of the zinc-deficient and zinc-sufficient areas within the

non-calcareous range top soil and upper and lower subsurfaces) were 5·9, 2·6, and 2·6 p.p.m., and 6·03, 3·40, and 4·03 p.p.m., respectively, the corresponding figures for the calcareous soils being 12·4, 10·4, and 10·5 p.p.m., respectively.

THURSTON (H. W.) & WORTHLEY (H. N.). **Sulphur and copper sprays in relation to Apple-tree growth and yield.**—*Phytopathology*, xxxiii, 1, pp. 56–60, 2 graphs, 1943.

Following up the investigations of Folsom and Christopher on the effects of fungicidal treatments on the growth and yield of apple trees [*R.A.M.*, xxi, p. 530], the writers report the results of trials carried out at the Pennsylvania Agricultural Experiment Station from 1934 to 1941 on Staymans planted in 1929. In the first year all the trees were given a single application of sulphur and lead arsenate at petal fall; in 1935 they were sprayed twice, at the pink stage, and petal fall; and from 1936 onwards a differential programme was followed, one lot being treated according to the standard sulphur-lead arsenate schedule and the other with copper phosphate-lime bentonite-lead arsenate (4-8-4-3-100); the copper phosphate was replaced in 1940 and 1941 by copper zeolite. As far as any definite conclusion can be drawn from the experimental data it may be inferred that the fungicidal treatments, by increasing the size of the crop, gradually slow down the annual girth increments. On the other hand, the sprayed trees held their crops until maturity, whereas those of the controls were largely lost through scab [*Venturia inaequalis*], the incidence of which amounted to 100 per cent. in 1937 and was only slightly lower in 1939 and 1940. Spraying can therefore hardly be implicated as a factor in the failure of orchards to yield profitable harvests.

MCCOLLOCH (L. P.). **An apple rot fungus morphologically related to a human pathogen.**—*Phytopathology*, xxxii, 12, pp. 1094–1095, 1942.

Since 1937 at the Bureau of Plant Industry Station, Beltsville, Maryland, the writer has studied 130 highly variable monospore isolates of the apple rot fungus referred to *Sporotrichum malorum* with a view to the determination of the taxonomic position of the pathogen and its relationship to *S. carpogenum* [*R.A.M.*, xi, p. 309]. A preliminary comparison of the experimental material (obtained from decaying fruits, cankerous apple wood, and surface soil below the trees) with a subculture of *S. malorum* from the Bureau voor Schimmelcultures indicated that the original classification by Kidd and Beaumont [ibid., iv, p. 174] was erroneous. In the first place, the dark pigment present in the hyphae, and to some extent in the spores, points to the accommodation of the species among the Dematiaceae rather than the Moniliaceae. Secondly, the sporulation process is characterized by a continuous proliferation of the sporogenous cells, forming conidia, united in mucous masses, through a collar-like apex, a feature which excludes the organism from the form-genus *Sporotrichum*. It is therefore transferred to *Phialophora* as *P. malorum* (Kidd & Beaumont) comb. nov., *S. carpogenum* being considered merely a strain of that species.

Notwithstanding the morphological similarities between *P. malorum* and *P. verrucosa*, the type species of the genus and the agent of chromoblastomycosis in man [ibid., xx, p. 16 *et passim*], there is no evidence of any relationship between the diseases caused by the two species. Apples inoculated with *P. verrucosa* remained sound, the fungus neither growing nor inducing any disintegration of the tissues even under semi-saprophytic conditions.

ISAAC (W. E.). **The storage disorders in some Apple varieties.**—*Fmg S. Afr.*, xvii, 201, pp. 775–780, 806, 5 figs., 1942.

Four years' tests (carried out at the Low Temperature Research Laboratory, Cape Town) of the storage behaviour of Golden Delicious, Granny Smith,

Ohenimuri, Red Delicious, Rome Beauty, Wemmershoek, White Winter, Pearmain, York Imperial, and Winter Red apples (kept for a week at 65° or 68° F. following removal from store) showed that soft scald [*R.A.M.*, xxii, p. 30] affected Rome Beauty alone to any significant extent, when this variety was stored at 29°, at which temperature it showed 18 per cent. soft scald.

'Breakdown' was not a major disorder except in Winter Red. It arose (1) from severe bruising (Red Delicious, Rome Beauty, Winter Red), (2) following water core [ibid., xix, pp. 290, 353], (3) from excessively cold storage (Rome Beauty, 29°), and (4) senescence. The evidence indicated that although susceptibility increases with increasing storage temperature, the breakdown mostly, if not entirely, results from bad bruises, water core, and senescence.

The greatest amount of storage pit (bitter pit developing in storage) [ibid., xx, p. 474] was shown by Red Delicious. When little storage pit was present, its occurrence in relation to temperature and length of storage was erratic. When a larger number of apples was affected, pitting was more prevalent at higher than at lower temperatures, though considerable irregularities in incidence were met with. The relationship was more marked immediately on withdrawal from store than after the apples had been kept for a few days at a higher temperature; it was also more marked during the earlier months of storage than during the late ones. These observations suggest that while storage temperature may have some effect on the number of apples that develop the trouble, lowering the storage temperature as a rule only serves to delay the onset of an inherent disorder.

Core flush [ibid., xviii, p. 187] was observed in Granny Smith, Ohenimuri, and Red Delicious. It develops at higher rather than lower storage temperatures, but during six months' storage it did not occur in Ohenimuri at 29° or 32°. At higher temperatures, however, this variety was particularly susceptible, both as regards intensity in individual apples, and number affected. Its relation to storage temperature was more erratic in Granny Smith apples, which are less severely affected than Ohenimuri.

Superficial scald, affecting the skin only or at most only a few mm. of the flesh, may develop as more or less circular areas, centring round the lenticels and measuring from under 1 to over 5 mm. in diameter. Diameters of intermediate size are generally noted (Rome Beauty, Pearmain). It may occur as diffuse or irregular patches. Continuously scalded areas may (Granny Smith) or may not be (Ohenimuri, Winter Red) slightly depressed. The affected areas vary from dirty grey and dirty green through light and medium- to dark brown. The appearance of the condition depends partly on length of storage and partly on the variety. Granny Smith apples develop two kinds of superficial scald, at lower and higher storage temperatures, respectively. One apple may show more than one kind of superficial scald, as is often observed on Rome Beauty.

Superficial scald is a widespread storage disorder of South African apples. In the varieties tested it occurred chiefly at two temperature ranges, 29° to 33° and 37° to 45°, the former type affecting Granny Smith, Red Delicious, and Wemmershoek, and the latter Granny Smith, Winter Red, Ohenimuri, and Pearmain. The superficial scald of Granny Smith developing at the higher storage temperatures is less severe and appears later in storage life than the form that develops at the lower temperature. Apples subject to the higher temperature form of superficial scald should be stored at temperatures under 35°, particularly Ohenimuri, which stores well at 32°, but may develop considerable superficial scald at 35° or above. Apples subject to the lower temperature form should not be stored at temperatures under 35° or over 37°.

Oiled paper wrappers are especially effective against superficial scald when the apples are stored at temperatures other than the optimum for the development of the scald concerned. They gave best results with Red Delicious, Wemmershoek,

and Pearmain, and were least satisfactory with Ohenimuri. Even where they failed to reduce the number of apples affected, they mitigated the intensity of the condition in the individual apples.

The consignments of Golden Delicious and York Imperial kept in storage did not develop superficial scald. With Rome Beauty the incidence of superficial scald in relation to storage temperature varies from season to season and district to district. It is apt to develop considerable superficial scald at all temperatures, but as a rule is more severely affected at higher than at lower storage temperatures. Except at the temperature most favourable to the disorder, however, the use of oiled wrappers entirely eliminates or substantially reduces the condition in this variety.

It is concluded that Golden Delicious, Ohenimuri, White Winter Pearmain, York Imperial, and Winter Red should be stored at about 32°, and Granny Smith, Red Delicious, and Wemmershoek at about 35° to 36°. Oiled wrappers should be used except with Golden Delicious and York Imperial, while Rome Beauty should, on the whole, do best at over 30° and below 35°, in oiled wrappers.

PALMITER (D. H.) & HAMILTON (J. M.). **'Fermate' new Du Pont fungicide.**—*Agric. News Lett.*, x, 3, pp. 57–58, 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 281, 1943.]

The most promising of the many organic compounds which have been tested as substitutes for sulphur in the control of fruit diseases is stated to be ferric dimethyl dithiocarbamate (F–D–D–C) [*R.A.M.*, xxi, p. 506], which effected absolute elimination of apple rust [*Gymnosporangium* (?) *juniperi-virginianae*], whereas sulphur reduced foliar infection by only 50 per cent. Applied to sweet cherries just before harvest at the rate of ½ lb. per 100 gals. water plus a spreader of ½ pint cottonseed oil, F–D–D–C protected the fruit from decay [due to *Coccomyces hiemalis*] for several days without leaving any perceptible deposit.

KIENHOLZ (J. R.). **Boron deficiency in Pear trees.**—*Phytopathology*, xxxii, 12, pp. 1082–1086, 1 fig., 1942.

Applications of borax to the soil surrounding Bartlett and Bosc pears at two localities in Oregon in 1940 and 1941, respectively, and at dosages of 12 oz. and 1 lb. per tree, respectively, entirely corrected a condition characterized by the formation of circular to angular, blunt-bottomed, shallow depressions on the fruit surface, especially near the calyx end, superficial dark- or light-coloured bark cankers with slightly raised, uneven borders on the younger branches, and die-back of the twigs, culminating in the death of the tree. Symptoms on the tree may develop without the fruit being affected. The pitting resembles that due to the stony-pit virus [*R.A.M.*, xviii, p. 463], and the two diseases often occur on the same tree. Little doubt is entertained by the writer as to the identity with stony pit of the pear diseases variously designated crinkle, bitter pit, and internal cork in Australasia [ibid., ix, p. 322; xvi, p. 471]. Treatment with borax failed to control black end of Anjou pears [ibid., xvii, p. 693], attributed to uncongenial stock and scion relations.

BLODGETT (E. C.). **Peach wart.**—*Phytopathology*, xxxiii, 1, pp. 21–32, 3 figs., 1943.

Peach wart [*R.A.M.*, xxi, p. 27], first observed in Idaho in 1938 and subsequently located in Washington and Oregon, is characterized by smooth or rough, pale tan to red outgrowths on the fruit tissues, particularly near the stylar end, usually accompanied by gumming, which may be very severe. The virus, which has been provisionally named *Galla verrucae*, is readily transmissible by budding and persists in the tree. Peach is the only known host, the varieties affected being J. H. Hale, Elberta, Candoka, Early Crawford, Halberta, Slappey, July Elberta,

and Seedlings. A slow natural increase of the disease appears to take place. Control should be based on the eradication of diseased trees and the use of sound wood for propagation.

HILDEBRAND (E. M.) & PALMITER (D. H.). **Control of X disease of Peaches by killing Chokecherry weed with ammonium sulfamate.**—*Agric. News Lett.*, x, 3, pp. 73–75, 1942. [Abs. in *Biol. Abstr.*, xvii, 1, p. 279, 1943.]

The virus of 'X' disease of peach, also known as yellow-red virosis, may spread from *Prunus virginiana*, its wild host, to orchards at a distance of 200 ft. For the destruction of shrubs or fence-row weeds of chokecherry ammonium sulphamate proved equal or superior to sodium chlorate. For shrubs ranging up to 4 ft., a spray consisting of $\frac{3}{4}$ lb. in 1 gal. water suffices to cover 100 sq. ft.

RASMUSSEN (E. J.) & CATION (D.). **A progress report on the yellow-leaf disease of sour Cherry.**—*Rep. Mich. hort. Soc.*, lxxi, pp. 100–105, 1941. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 2, p. 215, 1943.]

The slowly-acting virus responsible for yellow leaf [yellows] of sour cherries [*R.A.M.*, xxi, p. 442], present in Michigan for at least 20 years, is of economic importance as the cause of premature defoliation, progressive reduction in spur growth, decline in yields, and curtailment of the profitable life of the orchard. The disease does not respond to treatment by means of sprays, fertilizers, or cultural practices. The virus is transmissible by budding, but the mode of orchard dissemination has not been established, though there is some evidence that leafhoppers may act as vectors. Montmorency selections appear to vary in susceptibility. The propagation of nursery trees from healthy, high-yielding strains or selections is likely to become an important control measure.

DEMAREE (J. B.) & WILCOX (MARGUERITE S.). **Blueberry cane canker.**—*Phytopathology*, xxxii, 12, pp. 1068–1075, 3 figs., 1942.

A technical diagnosis is given of *Physalospora corticis* n. sp., the agent of a stem and shoot canker of considerable economic importance in the cultivated high-bush swamp and rabbit-eye blueberries (*Vaccinium australe* and *V. ashei*) plantings of Alabama, Florida, Georgia, Mississippi, and North Carolina, to which it is believed to have spread from wild plants of the same species in Florida and North Carolina. Cabot is the most susceptible of the high-bush blueberries, followed in descending order by Pioneer, Concord, June, Stanley, Jersey, Scammell, Rancocas, and Jubel, while Locke is the only one of the rabbit-eyes so far examined to show natural cankers.

The pathogen gains admission through the unbroken bark, probably by way of the lenticels of current-year shoots, the sites of entrance becoming apparent in the late summer or early autumn as reddish, broadly conical swellings, on the surface of which develop the black, conical to subglobose, ostiolate pycnidia, 90 to 208 μ high and 60 to 165 μ wide (mostly 105 to 140 by 70 to 100 μ), with carbonaceous walls, 10 to 30 μ in thickness. In the case of the susceptible Cabot and Pioneer varieties, the protuberances lose their reddish colour and conical shape during the second year after infection, when they begin to expand and develop fissures. The fungus invades the cortical tissues in all directions from the site of infection, the newly invaded bark swelling and its surface becoming blistered and turning pale grey. Besides the cortex and cambium, the xylem is also slightly penetrated with a certain amount of discoloration but no extensive necrosis. By the end of the second year of the attack or the beginning of the third, the older portions of the cankers are rough, black, and deeply fissured, the parts above the girdled shoots becoming unfruitful and finally dying. The cankers invariably make their first appearance on the side of the shoots directly exposed to the sun's rays.

The fusiform-elliptical, simple, hyaline pycnospores, 35 by 9 μ, arise from conidiophores 15 μ in length. Another type of spore, occasionally observed either in the pycnidia or in somewhat smaller fruiting bodies, is rod-shaped, hyaline, 3 to 7μ in length, and develops from relatively long conidiophores: this presumably constitutes a stage in the life-history of the fungus, being produced on maize meal cultures in flasks inoculated with the green, septate, coarse, sparsely branched mycelium from subcultures derived from ascospores, which are hyaline or slightly tinted, ellipsoid to fusoid, non-septate, 29·2 by 11·7 μ, and germinate rapidly, forming unbranched hyphae reaching a length of 142 to 380 μ in 19 hours. The perithecia of *P. corticis* are produced in much greater abundance than the pycnidia, which they superficially resemble apart from their pointed ostioles, sometimes elongated into beaks 50 to 100 μ in length. The clavate, eight-spored asci, very thick-walled at the apex, develop from the base of the perithecium, which seldom contains more than twelve and often only four to eight, and push their way upwards through a mass of white, erect, closely packed, short-celled, anastomosing hyphae, regarded by Shear *et al.* in their studies of *Botryosphaeria ribis* and *Physalospora obtusa* as a form of paraphyses [*R.A.M.*, iv, p. 178]. In some respects *P. corticis* is similar to *P. obtusa*, from which it differs, however, in the shape and colour of its pycnospores, its rate of growth in culture, its profuse perithecial development (the pycnidial stage being the more abundant in *P. obtusa*), and its failure to cause decay in apples.

The results of inoculation experiments afforded ample proof of the pathogenicity of *P. corticis*, especially on injured shoots. The most promising lines of approach to the control problem are the planting of disease-free plants and the use of resistant varieties.

Viégas (A. P.). **Notas sobre Polyporus sapurema Möller.** [Notes on *Polyporus sapurema* Möller.]—*Rodriguésia*, vi, 15, pp. 57–60, 24 figs., 1942.

Particulars are given of the writer's morphological, cultural, and cytological studies on *Polyporus sapurema* [*R.A.M.*, xvii, 192], immense sclerotia of which, weighing over 50 kg. each, were collected in 1938 in a new banana planting near the Ubatuba Experiment Station, Brazil. Pure cultures were obtained from fragments of tissue from the stipe and context, as well as from basidiospores *en masse*. On plain potato agar the mycelium is white, while the presence of gallic or tannic acid causes the development of an ashen-grey halo. The basidia of the fungus are binucleate and claviform, each bearing four basidiospores.

Muller (H. R. A.). **Overzicht van de belangrijkste Mangga-ziekten in Nederlandsch Indië.** [Survey of the principal Mango diseases in the Dutch East Indies.]—*Meded. alg. Proefst. Landb., Batavia*, 40, 9 pp., 1940. [English summary.]

Gloeosporium mangiferae is the most important pathogen of mangoes in the Dutch East Indies, attacking seedlings and nursery plants and the leaves, twigs, inflorescences, and fruits of older trees. Regular spraying with 1·5 per cent. Bordeaux mixture arrests the spread of infection. Damping-off (*Rhizoctonia* [*Corticium*] *solani*) is another disease of seedlings which may be combated by two soil treatments with ceresan applied at a dosage of 5 l. of a 1 in 5,000 solution per sq. m. ten days before sowing and again two days later after the soil has been thoroughly turned over to a depth of 20 cm., followed during the growing season by weekly spraying of the plants and soil with 1·5 per cent. Bordeaux. The bark canker caused by a species of *Physalospora* was very destructive to trees of 10 to 12 years old or younger at one locality in the Madoera district. The diseased areas should be excised and the wounds painted with a mixture of 92 per cent. hard paraffin wax and 8 per cent. carbolineum plantarium, a similar treatment being applicable

to the stems of trees invaded by *Botryodiplodia theobromae* as a sequel to injury by sun scorch, tar, or tangle-foot.

BITANCOURT (A. A.) & JENKINS (ANNA E.). **Scab of Mango caused by Elsinoë.**—Abs. in *Phytopathology*, xxxiii, 1, p. 1, 1943.

A species of *Elsinoe* resembling *E. fawcetti* but regarded as new [though not named] has been observed to cause the formation on mango leaves, stems, and fruits of lesions varying in colour and shape according to the age of the host and the country in which the scab occurs. On nursery plants at Santiago de las Vegas, Cuba, for instance, the spots are pale to brown and covered with a delicate buff down, representing the conidial stage of the fungus, and induce the crinkling and shedding of severely infected leaves, while the somewhat larger lesions on the older foliage are grey above, surrounded by a dark margin, and bear the small, nearly black ascomata of the perfect stage of the pathogen. In São Paulo, Brazil, the spots are circular to elongated or irregular, with a grey centre and dark periphery, following the midrib or disposed in proximity to it. Lesions of both the foregoing types have been observed at Manaos, Amazonas, Brazil, and in Puerto Rico, the Canal Zone, and Florida. A monoconidial culture was isolated from a Cuban sample and a tissue culture from Florida.

RUDOLPH (A. S.). **Some factors affecting the germicidal efficiency of hypochlorite solutions.**—*Iowa St. Coll. J. Sci.*, xvii, 1, pp. 114–116, 1942.

The author gives the results obtained in a study of the germicidal activity of the calcium hypochlorite (B–K) solutions tested at various concentrations, P_H reaction, and temperature, against *Bacillus metiens* at 20° C. P_H reaction was found to be a much more important factor in disinfection with hypochlorites than is the concentration of available chlorine.

IARI collection of fungi.—*Indian Fmg*, iii, 10, p. 548, 1942.

The Imperial Agricultural Research Institute is continuing its efforts, initiated before the outbreak of war, to organize a collection of typical fungus cultures for supplying workers in this field free of cost throughout India. Only a few hundred are at present available, and it is hoped that mycologists in different parts of the country will co-operate in the expansion of the collection by sending cultures to the Imperial Mycologist at the Institute, New Delhi.

MARTYN (E. B.). **Diseases of plants in Jamaica.**—*Bull. Dep. Sci. Agric. Jamaica* 32, 34 pp., 1942.

This bulletin falls into six parts, of which (1) deals with the types and symptoms of plant diseases; (2) with control methods, comprising cultural measures, the use of resistant varieties, and fungicidal treatments; (3) with some common groups of maladies, namely, virus diseases, root and collar rots, leaf spots, fruit rots, and anthracnoses; (4) describes some important diseases of the major crops cultivated on the island, namely, banana, citrus, coco-nut, and sugar-cane; (5) is concerned with the disorders of the minor crops, cacao, cassava, cocoes [*Xanthosoma*], coffee, maize, ginger, groundnut, pimento, potato, soy-bean, sweet potato, tobacco, tomato, and yams; and (6) treats of the diseases of garden crops (vegetables, fruits, and ornamentals).

DRECHSLER (C.). **Antagonism and parasitism among some Oomycetes associated with root rot.**—*J. Wash. Acad. Sci.*, xxxiii, 1, pp. 21–28, 3 figs., 1943.

In a cultural study of fungi associated with root rots of herbaceous cultivated plants, it was found that certain species of *Pythium*, e.g., *P. oligandrum*, *P. acanthicum*, and *P. periplocum*, are antagonistic to other members of their genus.

Thus, in dual cultures on soft maize meal agar (preferably one containing not more than 15 gm. of agar per l. and incubated at 28° C.), *P. oligandrum* vigorously attacked *P. ultimum* by enveloping the hyphae of the latter with its own intricately ramified hyphal branches, penetrating the enveloped hyphae of the victim and extending longitudinally within them to assimilate the degenerating protoplasmic contents. The destructive activity was highest in the narrow zone where young, vigorous hyphae of the aggressor came upon equally young hyphae of the victim. Conidia and young oogonia of *P. ultimum* were also attacked, but apparently less readily. The destruction was often so rapid and thorough that sexual reproduction of *P. ultimum* was only rarely permitted to reach a stage where the thick oospore wall affords reliable protection. *P. de Baryanum* and *P. irregulare* were also violently attacked by *P. oligandrum*, both in dual cultures and in isolation plate cultures on natural substrata such as tomato and pansy roots, and sugar beet and peach seedlings. Other species attacked by *P. oligandrum* were *P. mamillatum*, an undescribed *ultimum*-like species associated with pansy root rot in Columbia, *P. splendens*, *P. salpingophorum*, and to a lesser degree *P. butleri*, *P. graminicola*, *P. arrhenomanes*, *P. helicoides*, *P. oedochilum*, and *P. palingenes*. Similarly, *P. acanthicum* and *P. periplocum* could be observed in dual cultures to attack all the above-mentioned species with the same degree of severity as *P. oligandrum*, and in addition they readily attacked *P. marsipium*, indicating that aquatic congeners are not excluded from their destructive parasitism.

The three species thus observed to attack other members of their genus were all characterized by an abundant, delicate mycelium, the slender hyphae arising laterally from axial filaments of moderate width. All three species initiate and conclude sexual reproduction earlier than most congeneric forms. Coarse species, such as *P. megalacanthum* de Bary *sensu* Buisman, *P. mastophorum*, *P. polymastum*, and *P. anandrum* were readily attacked by all three delicate species, though with varying degrees of severity. *Pythiogeton autossytum* was attacked only feebly by *Pythium oligandrum* and severely by the other two.

In turn, *P. oligandrum* proved liable to attacks from a number of Oomycetes, e.g., *P. complens* and, in a very severe manner, *Plectospira myriandra*, the latter also attacking the other two aggressive species as well as a number of other congeneric fungi. Moreover, three strains of *Aphanomyces* from flax, spinach, and pansy, all referred to *A. cladogamus*, proved capable of attacking numerous species of *Pythium*, e.g., the spinach strain attacked *P. undulatum* and that from pansy *P. dissotocum*. A weak antagonism was also displayed by *A. cochlioides* against *P. de Baryanum*, *P. mamillatum*, and *P. myriotylum*. It is believed that both *A. cladogamus* and *A. cochlioides* are direct parasites on the phanerogamic plants on which they occur habitually; on the other hand, the spiny *A. exoparasiticus* may not be parasitic on phanerogams, as the several Saprolegniaceous fungi hitherto found attacking higher plants all had smooth oogonia. Both *P. periplocum* and *P. acanthicum* are believed to be direct parasites on watermelon. It is concluded that a capacity for causing disease in higher plants can coexist, in the Oomycetes under consideration, with a capacity for attacking and injuring other members of the ecological assemblage, the antagonistic relationship being apparently strongest where both fungi concerned are in a high state of vegetative vigour.

MARTIN (W. J.). **A simple technique for isolating spores of various fungi from exposed slides in aerobiological work.**—*Phytopathology*, xxxiii, 1, pp. 75–76, 1943.

The following method has been found to assist in the difficult problem of identification on exposed slides of the wind-borne spores of various plant pathogens and certain organisms responsible for allergic conditions in man. Under the low power

of the microscope, the position of a spore or spore group is marked with a crow-quill pen and India ink on the slide, which is then inverted over a Van Tieghem cell and single spores isolated by means of a micromanipulator, as described by Hanna [*R.A.M.*, viii, p. 323]. The manner of spore formation, an important feature in fungal determination, can thus be followed in the case of any spores germinating and giving rise to sporulating cultures. Thus, the ovoid, brown spores, 5 to 9 μ in diameter, present in thousands on vaseline-coated slides (3 sq. in.), which germinated after isolation in the above manner and produced promycelia with hyphal branches, were referred on this basis to one of the loose smuts, *Ustilago nuda* or *U. tritici*, and subsequently the same technique was successfully applied to a number of organisms, e.g., *Penicillium*, *Aspergillus*, *Trichoderma*, *Cephalosporium*, *Fusarium*, *Cladosporium*, *Rhizopus*, and *Pleospora*: none of these could have been reliably identified by the study of their somewhat nondescript morphological characters alone. Smut and *Fusarium* spores on exposed slides were found to be viable after three months and one month, respectively.

MARKHAM (R.), SMITH (K. M.), & LEA (D.). **The sizes of viruses and the methods employed in their estimation.**—*Parasitology*, xxxiv, 3–4, pp. 315–352, 1942.

An account is given of the known methods of measuring the size of virus particles, i.e., ultra-violet light and electron microscopy, X-ray diffraction, sedimentation and diffusion, filtration, and radiation inactivation. Published data on the sizes of animal and plant viruses and bacteriophages are summarized. Only in the cases of three viruses, tobacco mosaic, tomato bushy stunt, and vaccinia are the data thought sufficiently adequate to be able to state the size and shape and molecular weight of these viruses. It is suggested that in order to obtain precise data on the size of a virus, it should be studied in as purified a form as possible. It is thought desirable to apply several different methods of measurement before an estimate of size can be given with some confidence. A bibliography of 193 titles is appended.

ROBBINS (W. J.) & MA (ROBERTA). **Vitamin deficiencies of Ceratostomella and related fungi.**—*Amer. J. Bot.*, xxix, 10, pp. 835–843, 3 figs., 1942.

Continuing their earlier studies [*R.A.M.*, xxi, pp. 12, 468; xxii, p. 104], the authors grew 13 species of *Ceratostomella* and related fungi, viz., *Ophiostoma catonianum*, *C. multiannulata*, *C. obscura*, *C. pilifera*, *C. pluriannulata*, *C. stenoceras*, *C. microspora*, *C. penicillata*, *Grosmannia serpens*, *C.* (*G.*) *rostrocylindrica*, *Endoconidiophora* [*C.*] *paradoxa*, *E.* [*C.*] *coerulescens*, and *E.* [*C.*] *adiposa*, in a mineral-dextrose medium containing asparagin, and in the same medium supplemented with thiamin, pyridoxin, or biotin, singly and in combination, or with malt extract.

Eleven of the species showed complete or partial deficiencies for one or more of the three vitamins, viz., *O. catonianum*, *C. obscura*, *C. pilifera*, *C. multiannulata*, *C. stenoceras*, *C. pluriannulata*, *C. penicillata*, *C. microspora*, *G. serpens*, *C. paradoxa*, and *C. coerulescens*. Complete or almost complete deficiency for pyridoxin was shown by *O. catonianum*, *C. pilifera*, *C. multiannulata*, *C. pluriannulata*, *C. penicillata*, and *C. microspora*, for thiamin by *C. obscura*, *C. stenoceras*, *C. penicillata*, *C. microspora*, and *C. paradoxa*, and for biotin by *C. obscura*, *C. penicillata*, *C. microspora*, and *C. paradoxa*. Six of the fungi, viz., *C. multiannulata*, *C. pluriannulata*, *C. penicillata*, *C. microspora*, *C. obscura*, and *C. rostrocylindrica*, made conspicuously better growth in a medium supplemented with malt than in media supplemented with the three vitamins.

ROBBINS (W. J.) & MA (ROBERTA). **Vitamin deficiencies of twelve fungi.**—*Arch. Biochem., N.Y.*, i, 2, pp. 219–229, 1 fig., 1942.

Nine of the 12 species of fungi grown in a basal mineral-dextrose medium

containing asparagin and supplemented with thiamin, pyridoxin [see preceding abstract], and biotin, singly and in all possible combinations, showed partial or complete deficiencies for one or more of the vitamins. For instance, *Ceratostomella radicicola* [*R.A.M.*, xxi, p. 195] suffered from a total deficiency of thiamin (likewise absent from *C. paradoxa*) and an almost total lack of biotin; a perithecia-producing strain of *C.* sp. from London plane [*Platanus acerifolia*; ibid., xx, p. 610] was altogether destitute of thiamin and partially deficient in pyridoxin; thiamin was entirely absent from *Chalaropsis thielavioides* from lupin and rose [ibid., xxi, p. 19], and *Polystictus versicolor* was almost entirely lacking in thiamin and partially so in pyridoxin. The remaining three species, a strain of *Sclerotinia* from eggplant, *Claviceps purpurea* from rye, and *Stereum murrayii*, did not respond to any of the growth substances but grew better in a medium containing malt than in the basal substratum.

MUJICA (F.). **Patogenicidad de algunas cepas del Verticillium albo-atrum Rei. y Berth.** [The pathogenicity of some strains of *Verticillium albo atrum* Reinke & Berth.] *Bol. Sanid. veg., Santiago*, i, 2, pp. 7-20, 2 figs., 2 graphs, 1941.

The following tentative conclusions are drawn from the author's small-scale experiments on the comparative pathogenicity of ten strains of *Verticillium albo-atrum* [*R.A.M.*, x, p. 757 *et passim*], of which all but one, originating in Pennsylvania, were isolated from different hosts in various localities of New York State. The strains fell into three groups according to (a) their effects on the Irish Cobbler potato plants (Katahdin having also been tested but found to be immune) into which they were inoculated by the introduction of mycelial fragments or spore suspensions into the stems, infestation of the soil, or immersion of the roots in a spore suspension, and (b) their development in potato dextrose agar cultures. Group (1) consisted of two definitely pathogenic isolates from rose and eggplant, which made vigorous growth in culture; (2) comprised the weakly pathogenic strains from *Koelreuteria paniculata*, *Chrysanthemum* sp., *Acer platanoides*, and elm (*Ulmus americana*), of which the two former developed poorly and the latter abundantly in culture; and (3) was represented by the non-pathogenic isolates from *A. pennsylvanicum*, *Lonicera* sp., *Physalis* sp., and *Platanus* sp., the growth increments of which in culture proceeded regularly. The injurious action of the several strains on their experimental host was directly correlated with their temperature relations in culture, the minimum, optimum, and maximum for growth in this series of trials being determined as 3° to 6°, 18° to 24°, and 27° to 33° C., respectively.

Two of the first symptoms of the wilt induced in the potato plants in these inoculation tests were epinasty of the leaf petioles and the development of dark coffee-coloured spots or stripes on the stems, features believed to be here recorded for the first time in connexion with *Verticillium* wilt of the host in question.

The data here presented are considered to afford cogent evidence for the existence of physiologic specialization in *V. albo-atrum*.

GORHAM (R. P.). **Rhamnus alnifolia L'Hér., a winter host of Aphis abbreviata Patch, one of the aphids feeding upon Potato foliage.** *Canad. Ent.*, lxxiv, 5, p. 96, 1942.

Attention is drawn to the recent detection in Victoria County, New Brunswick, of dense masses of *Aphis abbreviata* Patch [a vector of potato viruses: *R.A.M.*, ix, p. 475] in the oviposition phase (late September to late October) on the leaves and stems of *Rhamnus alnifolia* growing within 500 ft. of a 165-acre field of potatoes which, in the previous August, had sustained exceptionally severe infestation by the aphid. Another winter host plant of *A. abbreviata* in York County is *R. frangula*.

PETERS (E. J.). **Stem-end vascular discoloration of Potatoes due to Fusarium oxysporum f. tuberosi.** *Amer. Potato J.*, xx, 1, pp. 10–12, 1943.

Out of 426 White Rose potato tubers grown in the Stockton Delta, California, in 1941, 380 were found to be infected by *Fusarium oxysporum* f. *tuberosi* [*F. cuoxysporum*], while a further 28 of doubtful appearance were referred to W. C. Snyder, who identified the same pathogen as the agent of the characteristic light to dark brown or black stem-end discoloration of the vascular tissues. The 380 diseased tubers were planted in 1942, each being cut into three seed pieces, together with a similar number which gave negative results in respect of fungal contamination on agar cultures. The percentages of healthy plants arising from the diseased and clean tubers were 3·4 and 83·9, respectively, while slight, medium, and heavy discoloration was shown by 12·2, 36·9 and 47·5 per cent., respectively, of the former, and by 10·2, 4·3, and 1·6 per cent., respectively, of the latter. The infected seed yielded 0·8 lb. per hill, equivalent to 201 100-lb. sacks per acre, and the clean 1·3 lb. (326 sacks). Since about 60 per cent. of the diseased tubers would fail to pass U.S. grade specifications, the use of discoloured seed would entail an economic loss of nearly 80 per cent. The pathogen was reisolated from every one of the 696 tubers cultured again, so that its exclusion from foundation seed stocks is clearly desirable.

Potatoes. *Bull. Me agric. Exp. Sta.* 411–C, pp. 281–343, 8 figs., 1942.

Apart from information already noticed from other sources the following items of interest are contained in this bulletin dealing with potato diseases in Maine. A method of controlling ring rot [*Corynebacterium sepedonicum*: *R.A.M.*, xxii, p. 37] at small initial expense has been evolved, based on a three-year plan of replanting: in the first year a plot (about $\frac{1}{100}$ of the total potato acreage of a farm) not previously under potatoes should be planted with new, disease-free seed stocks, taking care to disinfect all equipment beforehand; next year stock from this plot should suffice to plant $\frac{1}{10}$ of the total acreage, and the third year should see the entire farm re-planted with sound stock. When an ultra-violet lamp was used by R. Bonde and A. F. Ross for examining tuber samples [ibid., xxii, p. 107], 0·2 to 0·6 per cent. of tubers affected with ring rot escaped detection, as compared with 2 per cent. which were overlooked when no lamp was used. In addition to the results previously reported from disinfectant trials [ibid., xxi, p. 322], copper sulphate (1 lb. in 10 gals. water) was found very effective in killing the ring-rot organism on potato bags.

In continued studies by D. Folsom at Highmoor Farm [ibid., xxi, p. 499] one seedling tested for three years, and 19 tested for two years exhibited considerable resistance to leaf roll and showed some promise for table stock quality. The foundation seed potato programme initiated in 1939 [ibid., xxi, p. 322] is stated to have had a reasonable success. In the Florida test conducted since 1938 with a view to locating any good seed stocks in the State, the average foundation seed stock from Maine was consistently less affected by leaf roll than the average of other seed stocks represented. The results obtained with the various dates of harvesting in 1941 gave ample support for the recommendation for early harvesting as a means of avoiding much of the spread of leaf roll that may occur if vines remain green until normal digging time. The results of two years' fertilizer tests showed that chlorides favoured net necrosis [a symptom of leaf roll: ibid., xix, p. 492]. Potatoes stored at 33° F. for 120 days developed net necrosis in 18 per cent. of the tubers, while others from the same field stored at 47° for the same time showed 40 per cent.; potatoes from another field stored for 154 days showed 15 and 35 per cent., respectively, at the same two temperatures. It was also found that initial storing for 10 to 30 days at 34° reduced net necrosis development in subsequent

storage at 47° and one for 30 to 90 days even entirely stopped it. It is pointed out, however, that although temperatures near 32° or 33° help to control both net necrosis and stem-end browning in Green Mountain potatoes, they may cause the more serious mahogany browning [ibid., xxi, p. 302] in Katahdins, Chippewas, and Sebagos.

Fertilizers containing chloride were found to stimulate the development of stem-end browning [ibid., xxi, p. 322], and the results of all tests indicated that either the sulphate or the nitrate of potash, or a combination of the two, is just as effective a source of potash as the muriate. Potatoes stored at 60° developed 47 per cent. of stem-end browning as compared with 10 per cent. in those stored at 33°. The first 60 days in storage were found to be the most critical for the development of stem-end browning: potatoes stored for 120 days at 33° developed 13 per cent. stem-end browning, while those stored for 60 days at 33° and then at 52° for another 60 days developed only 14 per cent., and those stored for 30 days at 33° and then for 90 days at 52° developed 23 per cent. It is recommended, therefore, to adjust storage temperature for Green Mountains and Cobblers to about 33° as soon as possible after harvesting, while Chippewa, Katahdin, Sebago, and Houma should not be cooled below 36°, as they tend to develop mahogany browning at about freezing point or slightly above.

The purple-top disease [ibid., xvii, p. 480], the cause of which is as yet unknown, is stated still to present a serious problem. It would appear that there are two diseases with symptoms of purple top, one not affecting the seed quality of the tubers and another that does. The disease attacks all varieties, but particularly Katahdins and Sebagos.

The results of the 1941 studies (by R. Bonde and B. Plummer) on the *Rhizoctonia* [*Corticium*] *solani* disease [ibid., xxi, p. 322] indicate that the acid content of the solution used in the acidulated mercury dip method can be safely reduced from 1 per cent. in the standard formula to 0·25 per cent.; also that citric acid may be substituted for hydrochloric or acetic acids, although solutions prepared with acetic or citric acid were somewhat less effective than those acidulated with hydrochloric.

Late blight [*Phytophthora infestans*: ibid., xx, p. 30] is stated to have been very severe in Aroostook County in 1941 causing a loss estimated at about 10 per cent. of the entire crop. In fungicide tests against late and early [*Alternaria solani*] blights, conducted with the Houma variety in 1941 by R. Bonde, plots sprayed seven times a season with copper hydro arsenate and 'copper hydro arsenate ite' yielded four and five barrels more per acre, respectively, than did those sprayed with Bordeaux mixture. In comparative trials with different concentrations of Bordeaux mixture, early and late blight were controlled equally well by all the formulas tested, viz., 10–10–100, 8–8–100, 8–4–100, and 10–5–100. It is considered that the time of application and the maintenance of a good coverage of spray material at the critical period for late blight are more important, within limits, than the particular formula used.

In experiments conducted during 1941 by R. Bonde and G. W. Simpson for the combined control of diseases and insects, the addition of rotenone, in the form of ground derris root, to copper fungicides (Bordeaux mixtures 10–10–100 and 10–5–100, basicop 5–100, spraycop 6–100, and yellow cuprocide 1·5–100) resulted in an increase in yield of from 9 to 17 barrels of potatoes per acre, but failed, it is thought, to reduce the insect population sufficiently to affect the spread of leaf roll and other virus diseases. A new machine, 'Vapo-duster' (Root Duster Co., Cleveland, Ohio), intended for combined fungicide and insecticide treatment in controlling late blight and insects, was tested with promising results. With this machine, the copper-containing dust is expelled by tractor power with great force through one set of holes on the spray rig and the insecticidal oil mist through

another. The machine seemed to cause less plant injury than an ordinary tractor power sprayer. The lowest yields of potatoes were obtained in plots treated with Bordeaux mixture 10–5–100 (applied with the tractor power sprayer) without an insecticide, while an increase of 16 barrels per acre resulted from the application of a combined red copper oxide dust (6 per cent.), oil, and rotenone-pyrethrum insecticide applied by the Vapo-duster, and one of 14 barrels from the application of combined Bordeaux mixture and rotenone.

Stevenson (F. J.), Folsom (D.), & Dykstra (T. P.). **Virus leaf roll resistance in the Potato.**—*Amer. Potato J.*, xx, 1, pp. 1–10, 1943.

Leaf roll has become a serious problem in some of the best potato-growing regions of the United States. In varieties such as Katahdin, Chippewa, and Sebago, the reduction in yield results from the rolling and yellowing of the foliage and dwarfing of the plants, whereas in others, notably Green Mountain, further losses are caused by the development of net necrosis in the tubers [*R.A.M.*, xxi, p. 322]. Before the phenomenally heavy infestation of the aphid vectors of the disease in 1937, the incidence of leaf roll in Maine could be maintained at a minimum level by isolation, roguing, and early harvesting. However, since the extension of the trouble following the 1937 epidemic, and in view of the impracticability of aphid control, it has been necessary to resort to the breeding of resistant varieties, which has been carried out at two stations in Maine (Aroostook and Highmoor Farms) [see preceding abstract] and one in Maryland (Beltsville). Two methods of testing were practised in the earlier trials, tuber-grafting and field exposure, but the former proving too drastic to demonstrate the differences in resistance in the available material, only the latter was used in the later series. Among the reputedly resistant European varieties brought into the States only Triumf has remained free from infection. In 1942, after five years' exposure, this variety was free from leaf roll, which was present in Bevelander, Shamrock, Friso, West Brabander, Noordeling, and Albion to the extent of 32, 32, 57, 40, 72, and 85 per cent., respectively, while of the American varieties (three years), Green Mountain showed 88 to 100 per cent. infection, Chippewa 80, Katahdin 41, and Houma 10. None of 54 South American varieties showed entire freedom from the disease after one year's exposure, and the apparent escape in 1936–7 of seven of the 60 German 'W' selections from true seed supplied by K. O. Müller, Dahlem, proved to be only temporary, none of five tested again remaining free. Of 271 seedlings completely withstanding the epidemic of 1937–8 on the Aroostook Farm, 91 were from President × Katahdin, first grown in 1932, 30 from Katahdin × Earlaine (1934), 76 from 41956 × Katahdin, and 74 from 41956 × Earlaine (both 1935). The same 271 seedlings were planted at Beltsville in 1940, and 24 still remained free from leaf roll in 1941, but in 1942 only two showed no symptoms. In 1938, nearly 60 per cent. of the seedlings of a small progeny of Katahdin selfed from the 1937 tests were healthy compared with only 11 per cent. of Green Mountain.

During the period from 1938 to 1942, 65 crosses were exposed to leaf-roll infection in the field at Monmouth, Maine, ten of which were included for the first time in the latter year, so that their reactions cannot yet be recorded. During 1938 to 1942, of the 5,518 seedlings of 55 crosses exposed to infection, 300 (5·4 per cent.) showed no symptoms in 1942, compared with 90·5 per cent. in the Chippewa controls (in which the incidence of infection in the previous year was only 0·5 per cent., indicating the rigorous nature of the tests). Among the more promising crosses were Kepplestone Kidney × Earlaine and Imperia × Earlaine, and it is hoped that some of these may carry factors for resistance different from those of Katahdin.

While no systematic tests have been carried out to determine the tendency of the tubers to develop net necrosis as a result of the current season's infection by

the leaf-roll virus, observations over a protracted period denote that certain varieties, such as Katahdin, Chippewa, and Sebago very seldom, if ever, contract this malady.

ELMER (O. H.). **The prevention of ring rot in Potato seed stocks.** — *Rep. Kans. St. hort. Soc.*, xlvi, pp. 219–223, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 3, p. 713, 1943.]

Potato yields were greatly increased by ten minutes' immersion of the cut seed pieces in a solution of 6 oz. mercuric chloride per 25 gals. water acidulated with 1 per cent. hydrochloric acid for the control of ring rot [*Corynebacterium sepedonicum*], the results obtained by the application of a similar treatment to whole tubers being less satisfactory. A delay of 12 hours after cutting in the soaking of the seed pieces was found to vitiate the beneficial action of the disinfectant. Satisfactory sterilization of potato bags was effected by dipping them in a solution of 1 qt. formaldehyde per 30 gals. water.

WAGER (V. A.). **Controlling late blight in Potatoes.** — *Fmg S. Afr.*, xvii, 201, pp. 793–795, 1 fig., 1942.

Potato late blight (*Phytophthora infestans*) occurs in only a few areas in South Africa, and mainly affects seed potatoes in the highlands of the Transvaal (e.g., at Haenertsburg) and of Natal, in the Mooi River, Donnybrook, and Underberg areas. As a rule, the first crop from imported seed suffers most. The imported seed, mainly from Scotland, reaches South Africa in December or January and the crop matures towards the end of summer. Rainfall figures for Underberg for the past 15 years show that heavy rains can be expected at this period, and under these conditions blight may completely destroy the tops and turn the tubers into a rotten slimy mass. In Natal, late blight infection usually appears after a heavy rainstorm, and is most severe in heavy soils and hollow situations. The disease may originate in patches, one such patch observed being 20 yards long by 10 yards wide, whereas the surrounding plants were green and vigorous. Early blight (*Alternaria solani*) attacks potatoes wherever they are grown in South Africa, and at any season, causing extensive losses.

In a test against blight at Donnybrook, Natal, four rows dusted with copper oxychloride containing 16 per cent. copper, applied with a hand-worked rotary machine, gave 2436 lb., as against 2008 lb. for the controls, this increase being equivalent to 11½ bags of 150 lb. each per acre, or an increased profit of £20. The dust (70 to 80 lb. per acre) treatment cost about £2 per acre. The first application was made towards the end of February, and seven treatments were given in six weeks. During this period, there was over 6 in. of rain, and two hailstorms also occurred.

Growers are advised to make a dust application on the first morning after each rainstorm or as soon as there is a break in the weather. Not more than four or five days should be allowed to pass without applying a treatment. Dusting may be delayed until the first sign of infection is noticed, after which it should be carried out two or three times in one week, if the weather conditions warrant it. In dry weather, one treatment every 10 days or two weeks should suffice. Crops should be dusted five to eight times in the season, at the rate of 5 to 10 lb. per acre per application.

EXNER (BEATRICE) & CHILTON (S. J. P.). **Variation in single basidiospore cultures of Rhizoctonia solani.** — Abs. in *Phytopathology*, xxxiii, 1, p. 3, 1943.

In comparative cultural studies on 395 single basidiospore cultures of *Rhizoctonia* [*Corticium*] *solani* isolated from basidial mats on Lima bean [*Phaseolus lunatus*], potato, and alligator weed stems, up to 29 distinct cultural types, differ-

ing in growth rate, colour, sclerotial size and position, and zonation, were found to occur among the isolates from a single mat. Some form of segregation would thus appear to take place in the process of basidiospore production.

Ryker (T. C.). **Physiologic specialization in Cercospora oryzae.**—*Phytopathology*, xxxiii, 1, pp. 70–74, 1 fig., 1943.

This is an expanded account of the writer's studies at the Louisiana Agricultural Experiment Station on physiologic specialization in *Cercospora oryzae* on rice, a note on which has already appeared [*R.A.M.*, xix, p. 301]. There are now definitely known to be five physiologic races of the fungus, distinguishable by their pathogenicity to the Blue Rose, Blue Rose 41, Fortuna, and Calora varieties, while the addition to the test assortment of Colusa, Zenith, and Delitus resulted in the subdivision of race 1 into five sub-races, of race 2 into three, and of race 3 into six, making a total of 16 pathogenic races among the 36 isolates tested. The varieties Rexora, Nira, Iola, Kameji, and Shoemed proved resistant to all races of *C. oryzae*, while Honduras, Edith, and Carolina Gold were susceptible to most, and Vintula apparently heterozygous for resistance, a few individuals being susceptible. The widely grown Blue Rose variety is susceptible to most of the races known to occur in Louisiana, but a selection from it (41) [ibid., xxii, p. 37] is resistant to the most prevalent race 1. The objectionable weed, southern red rice, is ordinarily resistant to *C. oryzae*, but once it is permitted to gain a foothold through neglect of proper cultural measures, it may contract severe infection owing to the increase of the race 5 to which it is susceptible.

Fawcett (G. L.). **Notas sobre el « carbon » de la Caña de Azúcar.** [Notes on the 'smut' of Sugar-Cane.]—*Circ. Estac. exp. agríc. Tucumán* 114, 3 pp., 1942.

An account is given of the symptoms, mode of infection, and distribution of sugar-cane smut (*Ustilago scitaminea*), first definitely reported from Tucumán, Argentine, in 1940 [*R.A.M.*, xxii, p. 197]. On 17th August, 1942, spores of the smut were placed in five porous porcelain tubes, which were then hermetically sealed and buried in five large flower pots, three being sunk in the soil in the open air and the other two left without water (until the last three weeks of the experiment) in a shed. When the tubes were examined three months later, the three left out-of-doors contained only non-viable spores, as did also one of those in the shed, whereas the spores in the remaining tube had germinated and produced numerous sporidia. On 23rd February, 1942, pieces of healthy P.O.J. 36 cane shoots were placed in pots of heavily infested soil and gave rise to apparently sound plants which, however, after freezing during the succeeding winter, produced typically smutted buds in the spring. The problem of combating the disease has been complicated by its extension throughout the province, but stringent precautions in the matter of the destruction of infected buds should eliminate the smut in the course of two or three years since the spores in the soil die within a few months.

Cross (W. E.). **Observaciones y ensayos culturales relacionadas con el « carbon » de la Caña de Azúcar.** [Observations and cultural experiments in connexion with the 'smut' of Sugar-Cane.]—*Bol. Estac. exp. agríc. Tucumán* 37, 12 pp., 1942.

The sugar-cane varieties so far observed to be attacked by smut (*Ustilago scitaminea*) in Tucumán [see preceding abstract] are P.O.J. 36 and its variants M, striped, and Paz Posse (purple), and P.O.J. 234 (severely); Tuc. 472 (Señorita) (in a moderate degree); and Co. 270, 281, and 290, D. 1135, Kavangire, P.O.J. 2714, 2725, 2878, 2883, and 2961, S.N. 54, Tuc. 379, 630, 1111, 1406, 2605, 2611, 2613, 2622, 2634, 2645, 2651, 2657, 2680, 2683, 2701, and 2705, and Yon Tan San (mildly). The plots of susceptible varieties which were not infected by the middle of December, 1941, remained healthy for the rest of the season, but many con-

tracted the disease in the following spring. In the plots which showed smut symptoms in the spring of 1941, fresh infections appeared continuously among the newly developing buds, and in the succeeding spring the incidence of the disease was much higher than in the foregoing. The only cultural practice which seemed to bear in any way on the amount of smut infection was frequent spring watering, but climatic conditions exert an important effect on the course of the malady, which was favoured by the severe frosts of the two last winters and the protracted spring droughts, resulting in the debilitation and retarded development of the host.

Luthra (J. C.) & Sattar (A.). **Control of Sugar Cane smut.**—*Indian Fmg*, iii, 11, pp. 594–596, 1 pl., 1942.

The outcome of the author's experiments in the control of sugar-cane smut (*Ustilago scitaminea*) in the Punjab has already been summarized from another source [*R.A.M.*, xx, p. 135], but it may be of interest to recapitulate the following points in connexion with the perpetuation of the disease by (a) planting setts of infected shoots, (b) spores borne on buds, (c) infection of the buds of standing canes, and (d) ratooning the smutted canes. The germination of setts from diseased shoots in the trial plots amounted to only 16 per cent., as compared with 44 for the healthy controls, while 10·2 to 62·2 per cent. of the buds from normal canes smeared with spores at planting time gave rise to infected canes. Smutted shoots were produced by some 20 per cent. of the infected buds of standing canes within three months; the inoculated buds which failed to sprout were sown in the field next season, and diseased canes arose from 4·3 to 28·3 per cent. of the contaminated material. The ratooned stumps of diseased canes were found to harbour the mycelium of the pathogen and to produce a fresh crop of smutted shoots.

Carvajal (F.) & Edgerton (C. W.). **The perfect stage of Colletotrichum falcatum.**—Abs. in *Phytopathology*, xxxiii, 1, p. 2, 1943.

Old, dead sugar-cane leaves and leaf sheaths were observed during 1942 in Louisiana to bear abundant inconspicuous perithecia, entirely embedded in the tissues, of a species of *Physalospora*. In inoculation experiments with cultures from single ascospores, typical red-rot lesions with the characteristic conidia of *Colletotrichum falcatum* were obtained. The perithecia also developed on sterilized leaves inoculated in a moist chamber with pure cultures of *C. falcatum*, as well as on those transferred to a moist chamber after inoculation in the field. These organs agree closely with the description of the perithecia of *P. tucumanensis* Speg., the examination of a herbarium specimen of which labelled 'No. 418, separado, del tipo' from the Spegazzini Botanical Institute, La Plata, showed the perithecia to be slightly larger but otherwise in general agreement with the Louisiana red-rot fungus, which is therefore tentatively identified with *P. tucumanensis*.

McIntosh (A. E. S.). **Progress in contributing colonies of seedlings released by the British West Indies Central Sugar-Cane Breeding Station.**—*Trop. Agriculture, Trin.*, xviii, 12, pp. 232–237, 1941.

Particulars are given of the reaction to disease and other characters of some 'noble' and 'nobilized' sugar-cane seedlings (the latter being derivatives of crossing wild species with the 'noble' *Saccharum officinarum* and back-crossing the progeny to the 'noble' parent) released from the British West Indies Central Sugar Cane Breeding Station, Barbados, where the work of 'nobilization' was started in 1928. B.2935, the offspring of Ba.11569 × Ba.6032, is susceptible to mosaic and root diseases, but resistant to gumming [*Xanthomonas vasculorum*]. B.3439 (Ba.11569 × Q[ueensland] 813) is resistant to root rots and gumming, its reaction to mosaic in Barbados being variable; in Jamaica it shows a high degree of resistance to the last-named disease [*R.A.M.*, xxii, p. 79] and is altogether

probably the best general-purpose 'noble' cane ever produced at the Station, likely to assume a major commercial role in the British West Indies. B.34104(Co. 281 × B. H.10(12)) has so far been resistant to all the above-mentioned diseases in Barbados, but is highly susceptible to mosaic in Jamaica. B.35187 and B. 37161 (both 'nobilized') have given highly satisfactory results in Barbados in respect of resistance to all the diseases under observation.

ORIAN (G.). **Artificial hosts of the Sugar Cane leaf scald organism.**—*Rev. agric. Maurice*, xxi, 6, pp. 285–304, 2 pl., 1942.

A preliminary note on the results of the author's inoculation experiments on various plants with the agent of sugar-cane leaf scald (*Bacterium* [*Xanthomonas*] *albilineans*) has already appeared [*R.A.M.*, xix, p. 729]. The following further items of information are here presented. In the course of the investigations open leaf blades of the resistant DK 74, the fairly susceptible R.P.8, and the very susceptible Black and White Tanna varieties were found to respond positively to artificial inoculation with the bacterium through wounds, a method that had given negative results in the hands of other workers. Fine, reddish-brown, discontinuous streaks of varying lengths developed from the sites of inoculation in five to eight days, and the pathogen was reisolated from the infected tissues. In connexion with the colour of the streaks, the conspicuous white 'pencil' line, at any rate in Mauritius, almost invariably encloses a much finer, red streak, the former developing only if the vascular bundles of an expanding leaf contract infection before the plastids have turned green, and the latter due to the secretion by the host of a stain, not specifically associated with infection by *X. albilineans*, which occludes the vascular portion of the xylem with yellow to dark-coloured, gum-like masses. The susceptibility to infection of the open leaf blades may perhaps result in the passage of the causal organism from the newly emerged shoots into the stem. The fact that the normally resistant DK 74 sugar-cane variety, as well as a number of other plants immune from leaf scald in nature, readily react to inoculation with *X. albilineans* suggests that the behaviour of artificial hosts of a given pathogen does not necessarily afford a reliable criterion of their reaction to the disease in the field.

IKATA (S.) & YAMAUTI (K.). **Notes on the haustoria of some species of Peronospora.** —*Ann. phytopath. Soc. Japan*, x, 4, pp. 326–328, 6 figs., 1941. [Japanese.]

Sclerospora, *Plasmopara*, *Bremia*, *Pseudoperonospora*, and other genera of the Peronosporaceae have simple haustoria, but those of *Peronospora* are complicated in shape. The following observations were made on the haustoria of six species of this genus. (1) *P. schleideni* [*P. schleideniana*] on onion: mature haustoria tend to curl and some divide, but development is generally poor. The dimensions range from 80 to 100 by 2·3 to 5 μ or upwards. (2) *P. arborescens* on poppy [*Papaver somniferum*]: the young haustoria are sac-shaped, bending and dividing into a few branches at maturity, development being sparse. They measure 30 to 70 or upwards of 200 by 2 to 5 μ. (3) *P. media* on chickweed [*Stellaria media*]: the young haustoria divide and spread out at the tips, elongating at maturity when their dimensions are 15 to 70 by 2 to 7 μ. (4) *P. spinaciae* on spinach: the mature haustoria elongate and divide profusely, sometimes filling the host cells. They measure 5 to 7 μ in width (branches 2 to 4 μ). (5) *P. manshurica* on soy-bean: the young haustoria twist, coiling at maturity to resemble intestines, and measure 70 by 0·8 to 3 μ. (6) *P. brassicae* on radish: the haustoria are very different from those of all the other species examined, being flask-shaped when young with a neck 3 to 6 and a body 6 to 13 μ in diameter. Apical division usually occurs at maturity.

Holmes (F. O.). **Quantitative measurement of a strain of Tobacco-etch virus.**—*Phytopathology*, xxxii, 12, pp. 1058–1067, 2 figs., 1 graph, 1942.

Under appropriate environmental conditions, well-marked, necrotic primary lesions developed on *Physalis peruviana* leaves five to ten days after inoculation with the severe-etch strain of tobacco etch [*R.A.M.*, x, p. 60], which induces on tobacco both chlorotic mottling and intricate patterns of fine, white lines simulating etching, this feature being absent from the other hosts of the virus. Quantitative measurements of severe etch could be made by using the number of lesions resulting from each inoculation as an index of the virulence of the inoculum. By this means *Nicotiana glutinosa* was ascertained to be the best of the various hosts compared as sources of inoculum, followed by tobacco and tomato. Virus activity in expressed tobacco juices reached a maximum about ten days after inoculation and then declined rapidly.

The severe-etch virus withstood desiccation for at least ten days in diseased leaves and juice samples, though its infectivity diminished in both cases with the passage of time. It also retained its activity for a similar period in acid-buffer solutions (P_H 4·5 to 6) at temperatures just above and below freezing. Some degree of virulence was further left in samples exposed for ten minutes to a temperature of 53° or half-an-hour to one of 51° C. but not after ten minutes at 55° or 30 minutes at 53° [cf. ibid., xx, p. 590].

Woods (M. W.). **Effect of cyanide on synthesis of ring-spot and mosaic viruses in Tobacco.**—*Phytopathology*, xxxiii, 1, pp. 77–80, 1 fig., 1943.

The results of experiments under controlled conditions comparable to those obtaining in the writer's previous experiments on the inhibitory effect of sodium cyanide on the synthesis of the tobacco mosaic virus protein [*R.A.M.*, xix, p. 437] indicated that the infective principle of tobacco ring spot responds similarly to treatment with potassium cyanide (0·00015 to 0·0003 M.), which likewise reversibly blocks between 50 and 80 per cent. of the respiratory activity of the leaf [ibid., xxi, p. 228]. Biological assays for virus, in the form of local lesion counts on Turkish tobacco leaves, demonstrated the suppression by the chemical compound, not only of the necrotic symptoms of the disease, but also of the production of virus. For instance, in a test in which the ring spot-inoculated sectors were treated with 0·0003 M potassium cyanide for 24 per cent. of the entire time, a 55 per cent. reduction in virus titre was recorded, the same values in another trial being 22 and 41 per cent., respectively. When cyanide was administered at night only, the ring-spot lesions were much less necrotic and contained a smaller amount of virus than the controls or leaf sectors similarly treated during the day only, complete masking of the symptoms, in fact, resulting in some cases. These 'protected' diseased tissues continued to resist necrosis even after the discontinuance of the chemical treatment. In sectors treated with cyanide by day only, necrotic lesions developed, but more slowly and with a reduced virus titre in relation to the controls [cf. ibid., xiii, p. 477].

Whereas an external supply of nitrate (50 p.p.m. nitrogen) tended to diminish necrosis in ring spot-infected tobacco foliage, it stimulated the necrotic action of the yellow mosaic virus in the same leaves, but reduced the extent of peripheral yellowing in the lesions. Supplemental nitrate under the same conditions did not reduce necrosis due to yellow mosaic in a tobacco-*Nicotiana glutinosa* hybrid; but there was again a marked decrease in the amount of peripheral chlorosis. In the same hybrid, cyanide inhibited the synthesis of ring-spot protein, but in some cases there was a secondary stimulus to this process. In one experiment, for example, sectors were treated once with potassium cyanide for 23 hours, commencing 23 hours after inoculation, and 146 hours later, when the virus titre was determined, the extract from the cyanide-treated sectors produced 606 lesions as

against only 93 for the controls. The only prolonged alteration in the physiology of the hybrid tobacco leaves observed after exposure to cyanide was a marked reduction in the amount of brown pigment formed by oxidation (polyphenol dehydrogenase system) of tissues, which were killed by the virus after the cessation of the treatments.

Beach (W. S.) & Chen (S. Y.). **Experimental control of damping-off in Tomato seedlings transplanted from sand, including the immediate application of fungicidal drenches.**—*Bull. Pa agric. Exp. Sta.* 434, 26 pp., 3 figs., 1942.

In experiments conducted in Pennsylvania with the purpose of ascertaining whether lack of balance in nutrition in sand cultures can cause increased susceptibility to damping-off (*Pythium ultimum* and *Rhizoctonia* [*Corticium*] *solani*) in tomato seedlings after transplantation, no significant difference was found to exist between seedlings from ordinary sand cultures and those from steamed soil when transplanted into infected soil. Some evidence was obtained that over-concentration of nutrient salts, resulting in chemical injury, is a cause of increased susceptibility to damping-off. Considerable disease development was found to occur when washing the sand in hot water was omitted, this measure being essential for the removal of excess soluble salts and organic matter. Reduced moisture content of seed flats had no appreciable effect on the resistance of seedlings transplanted a comparatively short time after emergence; the resistance was slightly but significantly increased by extra potassium sulphate, but a high level of moisture had to be maintained to avoid chemical injury. After transplantation, seedlings showed a high degree of susceptibility to *P. ultimum* for about three days, and to *C. solani* for a much longer or even indefinite period. When *Pythium*-infested soil was thoroughly dried, damping-off was largely prevented, owing to the fact that the seedlings had passed their period of high susceptibility before the fungus could develop mycelium for attack. Optimum growing conditions, resulting in prompt renewal of growth after transplantation, tended to prevent damping-off. It is suggested that although under conditions of moderate attack the use of disease-free seedlings from sand cultures or steamed soil may reduce losses by approximately half in comparison with those incurred by the use of seedlings from untreated soil, yet in preventing severe losses, the maintenance of conditions unfavourable to damping-off development after transplantation is much more important than the resistance or the origin of the seedlings. Drying of infested soil and maintaining the most favourable conditions for growth of transplanted seedlings should insure complete absence of damping-off. In extreme cases, safe and efficient control can be obtained by applying fungicidal drenches to prepared flats of soil just before or after transplanting. In the present experiments, copper sulphate at the rate of 0·5 to 1 oz. to 30 sq. ft. was found to be effective against *P. ultimum*, particularly under moderate disease conditions, while semesan at the rate of 0·25 to 0·5 oz. and wettable spergon at that of 0·75 oz. to 30 sq. ft. were effective against both fungi. All these materials may be used dissolved or suspended in water at the rate of 1 pint to 1 sq. ft. It is advisable to rinse the fungicide from the stems and leaves with a limited amount of pure water and to place the plants where the foliage will dry readily but not in direct sunlight. Moist-chamber experiments indicated that some injury may occur under humid conditions; if these prevail, treatment of the soil before transplanting may be undertaken.

Hedayetullah (S.) & Saha (J. C.). **Bacterial wilt disease of Tomato.**—*Sci. & Cult.*, vii, 4, pp. 226–227, 1 fig., 1941.

At the Agricultural Research Station, Dacca, six seed and two soil treatments were tested, singly and in combination, for their efficacy in the control of tomato bacterial wilt (*Bacterium solanacearum*), which is stated to be assuming an alarming

character in various parts of Bengal, especially on red soils. Two varieties were used in the experiments, Dacca Farm and Sutton's Early Large Red, of which the former is the more resistant. Ten minutes' immersion in 1 per cent. mercuric chloride was the most effective of the seed treatments, and heating by burning a layer of rice stubble 3 in. in thickness and applications of kerol 1 in 400, 1 gal. per $30\frac{1}{4}$ sq. yds., the best of those applied to the soil. The heaviest yields were secured by a combination of kerol and 15 minutes' immersion of the seed in 2 per cent. copper sulphate.

Samson (R. W.) & Imle (E. P.). **A ring-spot type of virus disease of Tomato.**—*Phytopathology*, xxxii, 12, pp. 1037–1047, 2 figs., 1942.

This is an expanded account of the writers' studies at the Purdue University Agricultural Experiment Station on tomato ring spot, a preliminary note on which has already been published [*R.A.M.*, xvi, p. 501]. First detected in Indiana in 1930, the disease has since been found affecting up to 90 per cent. of the plants in many canning tomato crops in the southern part of the State, and has further been reported from Missouri and Illinois. Nine varieties, including Greater Baltimore, Marglobe, and Pritchard, have been observed to show spontaneous infection in the field, and the virus from tomato and *Datura stramonium* was successfully inoculated into other tomato varieties and 19 members of the Solanaceae, including potato, Turkish tobacco, *Nicotiana affinis*, eggplant, Ruby King pepper (*Capsicum frutescens*), *Hyoscyamus niger*, *Solanum pseudo-capsicum*, *S. carolinense*, and *Nicandra physaloides* (the two last-named and *D. stramonium* being natural hosts), two species of Amaranthaceae (*Amaranthus tricolor* and *A. retroflexus*), and one of the Martyniaceae (*Martynia louisiana*): from all these except pepper, *H. niger*, *A. retroflexus*, *S. pseudo-capsicum*, and *M. louisiana* the virus was recovered by return inoculation to *D. stramonium* and tomato. The symptoms of the ring spot closely resemble those of spotted wilt (though bronzing is not a characteristic feature), but the thermal death point of the former is higher (56° to 58° C. compared with 42°) and its host range narrower. Moreover, plants suffering from ring spot were not protected from infection by suspected spotted-wilt virus. The virus survived ageing in vitro for 21 hours compared with six for the tomato spotted wilt virus.

Differences in symptoms, host ranges, and properties indicate that the tomato ring-spot virus is distinct from the tobacco ring spot, potato ring spot, and tobacco ring mosaic viruses.

Tartakowsky (S. G.) & Arentsen (S. T.). **La roya del Alamo en Chile.** [The Poplar rust in Chile.]—*Bol. Sanid. veg., Santiago*, 1, 2, pp. 21–32, 1941.

Poplars in Chile, especially the widely cultivated *Populus nigra* var. *italica*, suffer severely from rust (*Melampsora larici-populina*) [cf. *R.A.M.*, xvii, p. 83], which was first recorded for the country by Spegazzini in *Rev. chil. Hist. nat.*, xxii, pp. 95–104, 1918, and subsequently mentioned in the archives of the Plant Protection Department in 1933, 1939, 1940, and 1941, an exceptionally severe outbreak having occurred in 1938, when the distribution of the pathogen extended from the province of Coquimbo to that of Chiloé. Although the disease was successfully combated in young (two- to three-year-old) plantings in 1939 to 1940 by spraying with 0·75 to 1 per cent. Bordeaux mixture, such a measure would be totally impracticable in the case of adult trees, which reach a height of 30 m. Control must therefore be based on the cultivation of resistant species, varieties, and hybrids, the most promising among those hitherto tested being *P. angulata*, *P.* sp. ('Calcufilo'), 'Arnaldo Mussolini' (*P. canadensis* × *P. nigra*), and German hybrid No. 7; specimens of *P. vernirubens* from Canada and ten hybrids from the United States proved susceptible (intensely so in some cases) to *M. larici-populina*.

Mook (P. V.) & Wolfenbarger (D. O.). **Distribution of Beauveria bassiana on Elm insects in the United States.**—*Phytopathology*, xxxiii, 1, pp. 76–77, 1943.

During 1941 and 1942 a survey was made for the presence of *Beauveria bassiana* on elm-inhabiting insects. Vera K. Charles reported the occurrence of the fungus on *Scolytus multistriatus* in New Jersey in 1941 [*R.A.M.*, xxi, p. 288], and the present report lists it as associated with the same host in Pennsylvania and Virginia, with *Hylurgopinus rufipes* in Massachusetts, New Hampshire, New Jersey, and Pennsylvania, with *Magdalis barbita* (1 out of 87), *M. armicollis* (1 out of 24), and *Tremex columba* (1 out of 1), in New Jersey, and with *Saperda tridentata* (10 out of 20) in New York. It is calculated that some 3 per cent. of all the insects cultured carried *B. bassiana*, *Scolytus multistriatus* and *H. rufipes* being the most important of its hosts in relation to the dissemination of Dutch elm disease [ibid., xv, p. 691; xxi, p. 433; *et passim*]. In the check list prepared by Miss Charles, 29 insect species or groups are cited as hosts of the fungus from 17 States ranging from Maine to Florida and from the Atlantic to the Pacific Coast, besides the District of Columbia, Canada, and the Dominican Republic.

Jones (T. H.) & Moses (C. S.). **Isolation of Ceratostomella ulmi from insects attracted to felled Elm trees.**—*J. agric. Res.*, lxvi, 2, pp. 77–85, 1 graph, 1 map, 1943.

With a view to identifying the species of insects spreading *Ceratostomella ulmi*, the cause of Dutch elm disease, insects were collected and cultured from 1936 to 1939 from felled healthy elm trees in several locations in New Jersey and New York States. The first year's collections were found to include 23 species of insects, as well as many other specimens that were determined only as to family or genus. *C. ulmi* was isolated most frequently from *Scolytus multistriatus* and *Hylurgopinus rufipes* [see preceding abstract], and also from *Xylobiops basilaris*, *Conotrachelus anaglypticus*, *Xylosandrus germanus*, and *Magdalis armicollis*. *S. multistriatus* and *H. rufipes* being considered the most important insect vectors of *C. ulmi* in the United States, only adults of these two species were cultured in the remaining years of these studies. In cultures made in 1936, 1937, 1938, and 1939, *C. ulmi* was isolated from 6·9, 5·8, 7·7, and 5·71 per cent. of the *S. multistriatus* insects, and from 4·3, 2·4, 3·3, and 0·7 per cent. of the *H. rufipes*, respectively. The percentage of insects contaminated with *C. ulmi* was found to vary considerably at different locations in the same year and at the same location in different years. Of the cultures made in 1936 and 1937, 71·2 and 76·6 per cent., respectively, were from *S. multistriatus* adult males. In 1936, *C. ulmi* was cultured from 6·9 per cent. of the males and from 7·1 per cent. of the females; in 1937 the percentages were 6 and 5, respectively.

Rupert (J. A.) & Leach (J. G.). **Willow blight in West Virginia.**—*Phytopathology*, xxxii, 12, pp. 1095–1096, 1942.

When the authors first observed the willow [*Salix*] blight in West Virginia in 1941 [*R.A.M.*, xxi, p. 355], the season was far advanced, and *Physalospora miyabeana* was the only organism associated with the diseased twigs. In May, 1942, however, *Fusicladium saliciperdum* [ibid., xxi, p. 544] was found fruiting profusely on infected petioles, while the acervuli of *P. miyabeana* were absent, though the fungus could be isolated from the cankers. In the following month, on the other hand, the acervuli of *P. miyabeana* were very active, whereas *F. saliciperdum* was distinctly on the decrease. The perithecia of *P. miyabeana* were detected in some of the cankers in the late summer and during the winter. Inoculation experiments with pure cultures of the two fungi showed *P. miyabeana* to be pathogenic to the stems and foliage of growing trees in the greenhouse and field, as well as to excised leaves in a Petri dish, in contrast to the failure of *F. saliciperdum* to attack growing

material and its feeble infection of detached leaves in a state of deterioration: the latter organism is therefore regarded as, at most, a weak parasite, comparable in its action to the species of *Cladosporium* and *Macrophoma* occurring in a saprophytic form on decaying material of outdoor willows.

Sleeth (B.). **Fusiform rust control in forest-tree nurseries.** *Phytopathology*, xxxiii, 1, pp. 33–44, 1 fig., 1943.

Effective but not absolute control of *Cronartium fusiforme*, the numbers of seedlings of slash pines [*Pinus caribaea*] destroyed by which in southern nurseries in 1938, 1939, and 1940 were estimated at 4,000,000, 3,000,000, and 1,000,000, respectively, was secured at Brooklyn (Mississippi) by spraying with 8-8-100 Bordeaux mixture with the addition of santomerse S or an emulsion of raw linseed oil and fish oil soap, bi-weekly applications being given during the first two or three weeks and then one treatment a week until early June [*R.A.M.*, xx, p. 187]. In the case of mid-March sowings the initial treatments were applied on 8th and 12th April, when the uredosori of the rust were observed on oak leaves near the nursery, the corresponding date for the plots sown in mid-April being 2nd May, several days after the development of the sporidia. The seedlings from the mid-April sowings showed only $\frac{3}{5}$ as many rust cankers as those of the earlier series. No appreciable reduction in the incidence of infection was obtained by the exclusion of oaks from a 1,500 ft. wide zone round a section of the nursery reserved for *P. caribaea*. Loblolly pines [*P. taeda*] grown under comparable conditions contracted less infection by *C. fusiforme* than *P. caribaea*, while longleaf [*P. palustris*] was even more resistant. Copper hydro (Chipman Chemical Co., Bound Brook, N. J.) was only slightly less effective than Bordeaux mixture, but dry lime-sulphur failed to give adequate control.

Ludbrook (A. J.). **Nine years' work on Pine forest disease.**—*Aust. Timb. J.*, viii, p. 910, 1942. [Abs. in *Emp. For. J.*, xxi, 2, p. 145, 1942.]

This is a popular summary of investigations into needle fusion of *Pinus* spp. in New South Wales and Tasmania already noticed from other sources [*R.A.M.*, xxii, p. 119; see also ibid., xxi, pp. 312, 407].

Rust disease of Norway spruce.—*Gdnrs' Chron.*, Ser. 3, cxiii, 2935, p. 127, 1943.

Attention is drawn to a severe outbreak of rust [*Chrysomyxa rhododendri*] on Norway spruces [*Picea abies*] in several localities in Britain in the autumn of 1942, previous records of which in the Solway area and Aberdeenshire date from 1913 and 1916, respectively. The alternate host of the pathogen is *Rhododendron hirsutum*. A much more common disease of spruces in Great Britain is caused by *C. abietis*, the alternate host of which, if it exists, has not yet been discovered.

Englerth (G. H.). **Decay of Western Hemlock in western Oregon and Washington.**—*Bull. Sch. For. Yale* 50, iv + 53 pp., 6 pl., 3 figs., 1942.

Observations of western hemlock (*Tsuga heterophylla*) stands from 1935 to 1940, involving the dissection of 801 trees, showed that the brown, stringy rot caused by *Echinodontium tinctorium* [*R.A.M.*, xx, p. 435] was not, as hitherto supposed, the most widespread agent of decay in this very important representative of the Pacific north-western forests, being confined to sickly trees at high elevations and on poor sites, and commercially negligible. *Fomes annosus* was shown to be responsible for 21 per cent. of the board-foot volume rotted, *F. pini* for 19·2 per cent., *F. applanatus* [*Ganoderma applanatum*] for 17·1, *F. hartigii* [ibid., xxi, p. 267] for 10·1, *G. oregonense* [ibid., xix, p. 445] for 7·2, *F. pinicola* for 6·7, *E. tinctorium* for 5·3, *Poria colorea* n. sp. for 4·3, *Armillaria mellea* for 3·7, *Polyporus sulphureus* for 2·3, *F. officinalis* for 1·5, *P. schweinitzii* for 0·9, and *Polystictus*

abietinus [ibid., xix, p. 315], *F. subroseus*, and *Poria subacida* for 0·1, 0·1, and 0·1 per cent. each. *F. annosus* and *G. applanatum* predominated along the coast, and *F. pini* and *F. hartigii* in the Cascade areas.

Infection was found to take place through scars inflicted by falling trees, mistletoe knots, broken tops, fire scars, lightning injury, and frost cracks beginning to be noticeable at 60 to 85 years and assuming a wide extension in 200-year-old trees. Although a greater proportion of infections occurred through falling-tree scars than through any other infection count, infections through mistletoe knots caused the greatest decay, amounting to 30·9 per cent. of the decay volume in board feet.

In order to form a reasonably accurate estimate of the amount of decay in western hemlock trees various indicators (e.g., sporophores, swollen knots, mechanical injuries, burls, branches hypertrophied by mistletoe, branch stools, and the appearance of the bark) may be used, while decay in logs may often be gauged from the stage of rot at the butt cut, the kind of rot being determined if possible by chopping into the punky knots, where the sporophores had been attached. The knowledge of the extent of decay thus obtained may be applied in estimating the value of sound trees, in making cull trees, and in measuring defective logs, with a consequent decrease in logging costs. Defective trees may be left standing to serve as seed trees if this is economically feasible. Little or no benefit is obtained by felling decayed trees in order to reduce the supply of inoculum. The best way of minimizing losses is to harvest the crop before it reaches the age when it is liable to appreciable decay.

P. colorea was found to be one of the more important butt rots in western hemlock. The sporophores are 3 to 7 cm. in diameter, annual, forming a tough coriaceous membrane with a broad sterile margin, and a pore surface which in dried specimens is pale yellowish red or rust-yellow; the tubes are less than 1 mm. long, angular, and average 4 to 6 per mm.; the spores are broadly ellipsoid, smooth, hyaline, 4·5 to 6 by 3·5 to 4 μ; cystidia of a narrow-fusoid type, 16 to 20 by 5 to 7 μ, are occasionally present, and the hyphae of the subiculum, 3 to 4 μ in diameter, are thick-walled, non-septate, and without clamps. The sporophores resemble those of *P. subacida* but differ in colour. They usually occur in root crotches of living trees and may be easily overlooked. The rot is characterized by small, white, irregular streaks or pockets on the radial surface. These merge and the wood is reduced to a white, stringy, or finely reticulate mass. Black flecks are scattered throughout the decayed wood. The wood substance finally disappears leaving a hollow butt. The decay may be confused with that due to *F. annosus* but differs in that no blunt-pointed pockets are present.

HARRISON (C. H.). **Longevity of the spores of some wood-destroying Hymenomycetes.** *Phytopathology*, xxxii, 12, pp. 1096–1097, 1942.

Under controlled laboratory conditions the spores of *Stereum hirsutum* freshly deposited by sporophores on glass slides and sown, after drying, on Sabouraud's dextrose agar at weekly intervals, were alive after 56 but not after 64 days' storage at room temperature, the corresponding periods for *S. rugisporum*, *S. sanguinolentum*, *Polyporus schweinitzii*, *Fomes igniarius*, *F. pinicola*, *Trametes* [*F.*] *pini*, *P.* [*Polystictus*] *abietinus*, and *Pleurotus ostreatus* being 45 but not 66, 131 but not 137, 162 but not 170, 91 but not 99, at least 173, at least 65, at least 65, and at least 20 days, respectively. Growth of *S. hirsutum*, *S. sanguinolentum*, *F. pinicola*, *Polystictus abietinus*, and *Pleurotus ostreatus* become visible in a week or less, while longer periods (up to two or three weeks) were requisite for the perceptible development of the other species. Germination of *F. igniarius* was erratic, some of the sowings failing to germinate. In an earlier test *Coniophora sistotremoides* spores grew when sown on casein-glucose potato agar after 46 but not after 68 days,

and those of *Hymenochaete tabacina* on walnut nutrient agar after 17 days' drying, growth being visible in 17 to 18 and four to five days, respectively.

TENG (S. C.). **Studies of Chinese timber trees in reference to forest management, I.**—*Sinensia*, x, 5–6, pp. 363–395, 7 graphs, 1940. [Chinese summary.]

The following observations are made on the wood-destroying fungi encountered in the course of the writer's ecological studies of the forests of north-western Yunnan and south-eastern Sikang (East Tibetan Plateau) in relation to silvicultural procedure. The Yunnan pine (*Pinus yunnanensis*) suffers extensively from a gall rust (? *Cronartium quercuum*), especially in open and pure stands on exposed sites. The same tree is a host of *Fomes laricis*, the agent of a brown, cubical heart rot, also affecting other conifers. A pecky heart rot of *P. yunnanensis*, Chinese larch (*Larix potaninii*), Likiang spruce (*Picea likiangensis*), hemlock (*Tsuga yunnanensis* and *T. chinensis*), and probably also the firs, *Abies georgei* and *A. chensiensis*, is caused by *F. pini* throughout the range of the investigations. The rot, which may extend into the sapwood, is characterized by numerous elongated pockets, usually filled with white fibres, the surrounding heart wood often being stained purplish or reddish, while the decayed areas themselves may be intersected by narrow, brownish to blackish lines. *F. putearius* Weir induces a decay very similar to the foregoing in *P. likiangensis*, *A. georgei*, and probably also in *L. potaninii*.

A prevalent, brown, cubical heart rot of the upper part of *P. likiangensis* trunks is caused by *F. carneus*, the decay apparently proceeding more rapidly after the death of the trees. *Polyporus dryadeus*, a well-known oak parasite, attacks *A. georgei* in south-eastern Sikang, inducing a soft, white rot of the butt and root-heart and sapwood. *P. volvatus* is found in abundance on *Pinus yunnanensis* trunks. A white pocket rot of *Picea likiangensis* sap and heartwood is caused by *Stereum sulcatum* and *S. chailletii*, while *S. sanguinolentum* is the agent of a similar decay of *A.* and *T.* spp. A powdery, brown rot of red paper birches (*Betula albosinensis*) in Sikang is due to *Polyporus betulinus*. *P. gilvus* produces a white rot of prickly oak (*Quercus semicarpifolia*) sapwood, which often cracks along the annual rings. Various broad-leaved trees, including birch, oak, and poplar, are subject to the pocket sapwood rot caused by *P.* [*Polystictus*] *pergamenus*, many hardwoods also being attacked by *P. versicolor*, the agent of a white, spongy decay of the sapwood. The prickly oak is also a host of *Trametes sepium*, which caused a brown, crumbly rot of the sap and heartwood. A white, spongy decay of many kinds of poplars is attributable to *T. hispida*.

The following fungi, already reported from the Hunba Forest (*Sinensia*, x, pp. 249–268, 1939), have likewise been encountered in the regions under observation: *F. pinicola* on *Pinus yunnanensis*, *Picea likiangensis*, *A. georgei*, and *Larix potaninii*, *F. annosus* on *P. likiangensis* and *A. georgei*, *F. fomentarius* and *Ganoderma applanatum* on prickly oak and red paper birch, *F. igniarius* on the last-named, poplar, and willow [*Salix*], *P. abietinus* on *Pinus yunnanensis*, *Picea likiangensis*, and *A. georgei*, *Polyporus schweinitzii* on *L. potaninii* and *A. georgei*, *P.* [*Polystictus*] *hirsutus* on red paper birch, and *Lenzites sepiaria* on *Pinus yunnanensis*.

HILBORN (M. T.) & STEINMETZ (F. H.). **The calorific value and chemical composition of decayed cordwood.** *Phytopathology*, xxxiii, 1, pp. 45–50, 1943.

In further studies (initiated by the senior author) in Maine on the effects on chemical composition and calorific value of the cordwood of red maple [*Acer rubrum*], paper birch [*Betula papyrifera*], and beech of decay by the white-rotting fungi, *Polyporus* [*Polystictus*] *hirsutus*, *Polyporus* [*Polystictus*] *pergamenus*, *Panus stipticus*, *Stereum purpureum*, *Thelephora* sp., and *Daldinia* sp. [*R.A.M.*, xvi, p. 138], two characteristics of this group of organisms were observed, namely,

the absence of a correlation between alkali solubility and the loss of any other component, and a depletion of cellulose and lignin proportional to the disorganization of the wood substance. One feature typical of the brown rots (which may have been present in the material examined, though their fructifications were not identified) was also noticed, namely, the preferential selection of the pentosans in cellulose. Chemical analyses failed to demonstrate a correlation between reduction in calorific value and reduction in amount of any chemical constituent and did not explain the slower loss in calorific value than in wood substance. Particle size resulting from mechanical screening in the reduced samples was shown to influence calorific value, which was higher in the minute particles passing the 100- and 200-mesh sieves than in those retained and submitted to chemical analysis.

Reid (D.). **Creosote penetration in Tabonuco wood as affected by preliminary boiling treatments in organic solvents.**—*Caribb. Forester*, iv, 1, pp. 23–34, 6 figs., 1942. [Spanish summary. Mimeographed].

The treatment of heartwood of tabonuco (*Dacryodes excelsa*), an important Puerto Rican timber, by standard preservative methods presents great difficulty owing to the hindrance of penetration by the presence of infiltrations of organic matter in the cell walls. This obstacle was overcome by the preliminary boiling of the wood for ten hours in kerosene [paraffin], which increased the penetration of creosote from 42·5 per cent. in the oven-dry control specimens to 70·3 per cent., the standard error of each of these averages being $\pm 6{\cdot}4$ per cent.

Szirmai (J.). **Újabb megfigyelések a palántak szártőbetegségéről.** [Recent observations on the damping-off of seedlings.]—*Mezőgazdas. kutatás.*, xiv, 4, pp. 125–127, 1941. [German summary.]

Among the economic plants affected by damping-off in Hungary are potato, tomato, chilli, lettuce, tobacco, and cabbage, and investigations were conducted at the Nagybakta Agricultural Experiment Station to determine the relative importance of *Rhizoctonia* [*Corticium*] *solani* and *Pythium de Baryanum* in the etiology of the condition. *C. solani* was found to be the predominant agent of the root rot and has probably been responsible for most of the damage from this source of recent years, *P. de Baryanum*, on the other hand, being only sporadically represented.

Myers (C. E.). **The Penn State Ballhead Cabbage. Some problems encountered in its development.**—*Bull. Pa agric. Exp. Sta.* 430, 52 pp., 48 figs., 1 graph, 1942.

The section of this bulletin dealing with the control of the pests and diseases encountered in the breeding of the Penn State Ballhead cabbage (pp. 28–34) contains the following items of interest. In 1940 a serious outbreak of disease caused by a species of *Alternaria*, probably *A. brassicae*, began to give trouble under storage conditions. This disease and black leg [*Phoma lingam*] were successfully controlled in seed plants by the following method: seed was treated with hot water (50° C. for 25 minutes), followed by a 20 minutes' steep in mercuric chloride solution (1 in 1,000), and then sown on land which had not been planted to cabbage oftener than once in four years. Apparently disease-free plants were selected for seed, the outer leaves removed, the soil washed from the roots by water from a hose, and the plants dipped in mercuric chloride solution before being placed close together in the trenches in which they were stored for the winter, covered with protecting boards and with soil scattered on the roots. In 1941, in a planting of $1\frac{3}{4}$ acres only four plants were observed to be injured by black leg and one by *Alternaria*. Yellows [*Fusarium conglutinans*], though prevalent elsewhere in the State, has only once been observed at the Station, in July, 1934,

when the two infected plants were removed and burnt, the soil of the site they had occupied drenched with a 10 per cent. solution of formalin, and a barricade erected to prevent ingress to the focus of infestation. In the following year one more diseased plant was detected and similarly treated, since when there has been no recurrence of the trouble. Infection is suspected to have been conveyed by a field assistant from an infested garden $1\frac{1}{4}$ miles distant.

WALKER (J. C.), JOLIVETTE (J. P.), & MCLEAN (J. G.). **Boron deficiency in Garden and Sugar Beet.**—*J. agric. Res.*, lxvi, 3, pp. 97–123, 6 figs., 1943.

The development of boron deficiency symptoms in seedlings of garden beet [*R.A.M.*, xxi, p. 442] grown in quartz-sand culture was observed in the greenhouse in Wisconsin. In seedlings grown from the beginning in nutrient solutions free from boron, symptoms developed promptly as an intensification of red pigment, unilateral development of leaf lamina, stunting, and death of the growing point. When seedlings were transferred to boron-deficient solutions after 30 to 40 days of healthy growth, similar symptoms appeared more slowly. In garden beets grown in nutrient solution until the tap-root had enlarged, typical black spot gradually appeared in the recently formed vascular rings on the boron supply becoming exhausted. Plants raised in the greenhouse on soil from fields where severe black spot of garden beet or heart rot of sugar beet had occurred did not show acute symptoms, and diagnosis of boron deficiency by pot tests was not satisfactory.

In field experiments conducted from 1938 to 1941, application of borax to the soil consistently reduced the amount of internal black spot in garden beets and of heart rot in sugar beets. Other minor elements, such as manganese, zinc, copper, iron, and cobalt, applied as soluble salts, had no effect on disease development. Smaller amounts of borax were needed to control heart rot than internal black spot, the latter disease defying as heavy applications as 100 lb. borax per acre. A survey of Wisconsin fields during the growing seasons of 1937, 1938, 1939, and 1940, showed that internal black spot was present most frequently in soils with a neutral or alkaline reaction, from light sandy to dark silty clay loam, and was about equally prevalent in high and low parts of the field. Broadcast applications of borax to slightly alkaline Poygan silty clay loam in 1938 prior to planting, were effective in entirely eliminating heart rot for two successive seasons and partly so for the third, and in much reducing internal black spot for two seasons, without causing injury to either garden or sugar beet even at rates as heavy as 60 lb. borax per acre. Application of borax with the fertilizer in bands $1\frac{1}{2}$ to 2 in. removed from and at the same depth as the seed were as effective as broadcast treatments. Yields of garden beets were commonly but not invariably increased by borax treatment. An increase in yield was observed in one case where the boron naturally available in the soil was sufficient to prevent internal black spot. Black spot was effectively controlled by mid-season applications of borax, particularly in liquid form, when carried out just before or immediately after the appearance of first symptoms. The canning quality of garden beet was not impaired by applications as heavy as 100 lb. borax per acre. On plots of Antigo silt loam supplied with various amounts of lime in 1935, black spot appeared five years later only where the soil reaction was alkaline. In plots of Plainfield sand similarly treated, however, black spot appeared everywhere (and severely in one with a P_H reading as high as 6·0 in one year), increasing with heavier dosages of lime. It is concluded that soil types differ in the degree to which available boron is tied up by liming and that in sandy soil boron deficiency is intensified by liming without the soil approaching an alkaline reaction and that some of the boron remains unavailable to plants over a period of several years.

Gaskill (J. O.). **Effect of mosaic upon yield of seed by Sugar Beet roots.**—*Proc. Amer. Soc. Sug. Beet Tech.*, pp. 199–207, 1940. [Abs. in *Sugar*, xxxviii, 2, p. 36, 1943].

Mosaic disease is stated to be widespread among the several hundred acres of sugar beet produced annually in northern Colorado, largely by the ordinary 'steckling' method, and a two-year series of experiments revealed a difference of 34·97 per cent. in seed yield between plots planted with diseased and healthy roots, heavy losses resulting both from first- and second-year infection.

Mujica (F.). **La septoriosis del Apio.** [The septoriosis of Celery.]—*Simiente, Santiago de Chile*, xii, 2, p. 81, 1943.

This is a popular note on celery blight [attributed to *Septoria apii* and *S. apii-graveolentis* in the Argentine: *R.A.M.*, xvii, p. 498; xx, p. 9], the losses due to which in Chile are estimated to average 10 to 15 per cent. of the value of the crop, covering 150 to 200 ha., i.e., a minimum of $150,000 per annum. Obviously the most rational method of control is that based on the observations of Krout in the United States, consisting in the use of three-year-old seed, since the spores of the pathogen lose their viability after the second year. The application of disinfectants to the seed is attended by various disadvantages, hot water and mercuric chloride, for instance, being more or less injurious to the seed, while formalin, though comparatively innocuous, is not so effective. Once infection has actually appeared in the plantings, regular treatments with 1 per cent. Bordeaux mixture should be given.

Bucha (H. C.). **Seed treatment as an aid in the wartime production of Peanuts.**—*Agric. News Lett.*, x, 5, pp. 114–122, 1942. [Abs. in *Exp. Sta. Rec.*, lxxxviii, 2, p. 209, 1943.]

Seed decay in the soil is stated to be largely responsible for sparse stands of groundnuts, resulting in low yields. In the author's greenhouse and field trials, the sulphur compound 50 per cent. tetramethyl thiuram disulphide (Du Bay 1205-FF) compared very favourably with ceresan in the prevention of rotting and stimulation of emergence. The routine application of seed treatment should provide a simple and inexpensive means of increasing farm incomes and simultaneously of meeting the greatly enhanced war-time demand for groundnut oil.

Fawcett (G. L.). **Una enfermedad comun de la Vid.** [A common Vine disease.]—*Circ. Estac. exp. agríc. Tucumán* 112, 2 pp., 1 fig., 1942.

Vine anthracnose [*Elsinoe ampelina*] is prevalent every year in Tucumán, Argentine, where grape production, however, is not as important as elsewhere in the Republic. Diseased vines cannot be saved, but the following preventive measures may be adopted. During the winter, after pruning, the dry twigs and shrivelled bark should be removed, and a mixture of 3·5 kg. iron sulphate, 70 c.c. sulphuric acid, and 10 l. water applied to the trunk and thicker branches with a brush or rag. In the case of small vineyards the sulphuric acid component of the fungicide may be omitted, its inclusion not being essential and requiring extreme care on the part of the operators. A solution of 1 per cent. copper sulphate may also be used during the dormant period, but neither this nor iron sulphate should be applied later for fear of injury to the leaves and buds. Subsequent treatments should consist of Bordeaux mixture (1 per cent.), the first as soon as the racemes are formed and thenceforward at intervals of one, two, or three weeks.

Jenkins (Anna E.) & Bitancourt (A. A.). **La antracnosis de la Vid en Chile. Resumen.** [Vine anthracnose in Chile. Summary.]—*Bol. Sanid. veg., Santiago*, 1, 2, pp. 33–34, 1941.

The late arrival of the summary (translated into Spanish by F. Mujica) of the

authors' paper on vine anthracnose (*Elsinoe ampelina*) in Chile precluded its appearance at the time of publication [*R.A.M.*, xxi, p. 481].

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xvi, 12, p. 170M, 1942.

'Germany (Sudeten Territory).' A Decree of 14th July, 1942, relative to hop mildew (*Pseudoperonospora humuli*) control, prescribes the training of the shoots to a height of at least 4 m. from the ground, along which they must not be allowed to trail. A maximum of three shoots may be kept as reserve stock. Diseased shoots should at once be removed and burnt. At least three times a year the hop gardens should be sprayed with copper washes or treated in some other manner recognized as effective by the Plant Protection Service. Plant refuse left in the field after harvest should be removed before the leaves turn yellow and burnt within four weeks unless required for any other purpose.

Martyn (E. B.). **Plant Pathological Division.** *Rep. Dep. Sci. Agric. Jamaica 1941–42*, pp. 11–12, 1942.

Croucher (H. H.). **Leaf Spot Control Division.** *loc. cit.*, p. 12.

In his report on plant disease work in Jamaica [cf. *R.A.M.*, xxi, p. 241], E. B. Martyn states that during the period under review Panama disease of bananas *Fusarium oxysporum* [var.] *cubense* continued to increase, though checked to some extent by dry weather. There were in all 684,085 cases treated, 772 new cases, and 667,619 recurrences. These figures were lower than those for the previous year, owing to further abandonment of treatment and withdrawal of inspectors in the eastern parishes in localities where the eradication of affected plants no longer serves any useful purpose. Banana leaf speckle was ascertained to be due locally to the same fungus that causes the disease in Surinam [*Chloridium musae*: ibid., xvi, p. 476]. A case of plantain wilt in a Kingston garden was suspected to have been caused by 'moko' disease, but the causal organism, *Bacterium solanacearum* [ibid., xix, pp. 158, 662], was not isolated. The black scabs typically appearing on the leaves and fruit of the Tiger plantain were recognized as being similar to those described and figured by Wardlaw (Diseases of the Banana, 1935, p. 273) in his account of a disease of 'black' plantains in Martinique. A similar condition slightly blemished a few Gros Michel fruits. The scabs, which appear to be superficial, are possibly due to insect injury.

Examination in the field of coco-nuts affected with bronze leaf wilt [*R.A.M.*, xxi, p. 242] confirmed the view that the disease is not infectious and is due to environmental conditions.

Carrot leaf blight (*Macrosporium carotae*) [ibid., xx, p. 560], though reported only once before, appears to be moderately prevalent, though it is not, as a rule, serious; its incidence is seasonal.

Rust-coloured patches on the trunk and lower limbs of pimento trees may, it is thought, have been caused by scorching of the new bark during dry weather.

New records for Jamaica included leaf spot (*Cylindrocladium* sp. near *C. scoparium*) of bullet wood (*Dipholis salicifolia*) seedlings, onion leaf spot (*Alternaria porri*), rice brown spot (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*], and turnip leaf spot (*Colletotrichum higginsianum*).

In his report on leaf spot [*Cercospora musae*: ibid., xxi, p. 242; xxii, p. 33], H. H. Croucher states that intensity of incidence resembled that of the previous year, save for unimportant fluctuations. A slight increase occurred in the eastern districts, which, however, are still among those least affected. Control measures are necessary only in small areas in Portland parish, a locality where the rainfall is very heavy. In the Montego Bay River Valley, which still contains the largest block of bananas in Jamaica, the effects of soil erosion have become so serious that

whereas the entire area was recently an almost uninterrupted field of bananas, the ridges are now exposed, and banana cultivation is receding down the slopes of the secondary ridges. Panama disease, confined until recently to the lower sections, is now attacking parts of the slopes. Excellent control of *C. musae* by spraying with Bordeaux mixture or perenox has been maintained, especially by the larger growers, who carry out the treatments regularly and efficiently. Some of the growers who formerly used perenox have now discarded it in favour of Bordeaux mixture, because of the better visibility of the latter, which facilitates supervision of the spraying.

The duties of officers of the Leaf Spot Control Division in controlling the supplies of spraying material and equipment issued by the Banana Leaf Spot Control Board have been modified by the introduction, in two areas, of a system by which, instead of each company assuming responsibility for the supervision of the spraying effected by its contractors, a joint Committee supervises the spraying done by all the growers. The Board has bestowed wide powers on these committees as regards the distribution of equipment and material, with the result that the duties of the Government Officers have been correspondingly reduced. The system has not been applied to the Eastern Division.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xl, 12, pp. 635–639, 6 figs., 1942.

Even under conditions strongly favourable to infection, peach fruits in the Goulburn Valley, Victoria, do not, apparently, become susceptible to rust (*Puccinia pruni-spinosae*) [*R.A.M.*, xxi, p. 123] until December at the earliest, with the result that fruit infections occur only when the summer rains fall in that month or later. In addition to favourable weather conditions a spore load from earlier leaf infections must be present before fruit infection takes place. If no leaf infection is detected between early spring and December, spraying becomes superfluous; if, however, such infection is found, a spray should be applied in December to protect the fruit. Dry-mix lime-sulphur (16 lb. dusting sulphur, 8 lb. hydrated lime, and 1 lb. lime casein spreader used in the proportion of 25 lb. of the mixture per 100 gals. water) is recommended; with late canning peaches, a second application may be necessary against very late fruit infection.

Peach leaf curl (*Taphrina deformans*) [ibid., xxi, pp. 147, 338] can be completely controlled by thorough spraying with Bordeaux mixture (6–4–40) in the very early pink-bud stage.

Blossom-end rot of tomatoes [ibid., xxi, p. 541] is common locally, particularly in the northern parts of Victoria, but responds to any treatment that helps to maintain an even soil moisture content.

Science for the farmer.—*Rep. Pa agric. Exp. Sta., 1941–42* (*Bull.* 429), 44 pp., 15 figs., 1942.

On p. 11 of this report [cf. *R.A.M.*, xxi, p. 522] it is stated that twelve or more strains of potatoes resistant to blight [*Phytophthora infestans*], tested by W. R. Mills in Pennsylvania, appeared to be very promising. Seed supplies are being rapidly increased and placed in yield tests. In tests by H. W. Thurston potatoes sprayed with Bordeaux mixture 8–8–10, 8–4–100, yellow copper oxide, and tribasic sulphate yielded, respectively, 415, 371, 372, and 412 bush. per $\frac{1}{100}$ acre, indicating the possibility of using the two last-named substances in place of Bordeaux mixture. Both plots sprayed with the substitute coppers showed more tip-burn and matured a week to ten days earlier than the others.

On p. 35 W. S. Beach is stated to have found that thorough drying of soil heavily infected by *Pythium* almost completely controlled damping-off when vegetable

seedlings were transplanted to it. Treatment with semesan, copper sulphate, and spergon (chloranil) was also safe and effective.

Fifty-fourth Annual Report of the Vermont Agricultural Experiment Station, 1940–1941.—*Bull. Vt agric. Exp. Sta.* 475, 40 pp., 1941. [Received April, 1943.]

The following items of phytopathological interest occur in this report. Eight out of ten proprietary brands of wettable and flotation sulphur tested by M. B. Cummings and C. H. Blasberg for their efficacy against apple scab [*Venturia inaequalis*] gave satisfactory control, reducing leaf infection from 66·5 to between 0 and 8·8 per cent. and fruit infection from 90·2 to between 0·81 and 3·6 per cent., the incidence for lime-sulphur (1 in 50) being 0·25 and 1·27 per cent., respectively. Three of the preparations, however, caused severe russeting (up to 30·55 per cent.), apparently owing to the use of a commercial oil as a sticker and spreader.

B. F. Lutman has found the potato scab (*Actinomyces*) [*scabies*] problem to be much more complex than was formerly supposed. The most prolific growth and the maximum of infection have been observed on areas retaining the most moisture after rainfall [ibid., xxi, p. 156]. Laboratory studies on early infection of young tubers by the pathogen [loc. cit.] indicate that not only scabby ones but all contain hyphae between the cells in the walls and in the intercellular spaces.

Fifty-second Annual Report for the fiscal year ended 30th June, 1942.—*Bull. Wash. St. agric. Exp. Sta.* 425, 121 pp., 1942.

In the section of this report [cf. *R.A.M.*, xx, p. 346] dealing with plant pathology (pp. 65–75), the following items are of special interest, apart from others already noted.

C. S. Holton confirmed the identity of the five new races of wheat smut (*Tilletia tritici* [*T. caries*] and *T. levis* [*T. foetida*]) described in 1940 [ibid., xx, p. 347; xxi, p. 329]. New collections of both fungi totalled 135, one of which may be a new race. Pathogenicity in the bunt fungi appears to be inherited on a multiple factor basis. Transgressive inheritance of pathogenicity factors is indicated by the fact that some hybrid segregates with more, and others with less virulence than either parent were obtained. Turkey (C.I. 10098) was resistant to all except the Oro race (L-8), Akron (C.I. 11660) was susceptible to all races, and Brevon (C. I. 11912) was resistant to all except the Ridit races (T-11, L–9, L–10). Eleven wheat × *Agropyron elongatum* selections were tested for bunt resistance; six were resistant and five susceptible, infection ranging from 13·1 to 81·8 per cent.

Flag smut of wheat (*Urocystis tritici*), first observed in Washington in 1940 [ibid., xx, p. 107], was more prevalent in 1941, being found in 21 of 58 fields near Goldendale; infection ranged from a trace to about 3 per cent. Eighty winter and spring wheat varieties were tested for resistance to flag smut, and most, including the leading commercial varieties of the Pacific Northwest, were found to be highly susceptible. A few varieties, however, were highly resistant, a supply of resistant parent stock for breeding purposes being thus assured.

A survey by L. Campbell of beet fields in Skagit County showed that the beet seed industry is in a precarious position. In the leaves of the seed stalks islands of necrotic tissue appear in spring, and the whole stalk rapidly dies; in many cases the mother beet decays. The yields are reduced by 50 to 60 per cent. In a high percentage of the plant beds the stecklings failed to develop vigorously; the leaves reddened prematurely and many of the beets failed to become large enough to store. Black root [*Phoma betae*: loc. cit.], mosaic [ibid., xvii, p. 440], and downy mildew [*Peronospora schachtii*: ibid., xx, p. 333; xxi, p. 317], though common, were serious in only a few beds and the trouble appears to have been primarily due to drought and malnutrition.

G. W. Fischer states that in 1939 mature plants of slender wheatgrass [*Agropyron*

tenerum], crested wheatgrass [*A.* sp.], and Canada wild rye (*Elymus canadensis*) were inoculated by clipping back and spraying with spore suspensions of *Ustilago hypodytes*. In 1940, no infection developed, but in 1941 three rows of slender wheatgrass inoculated with *U. hypodytes* from quack grass, giant wild rye [*E.* sp.], and blue wild rye (*E. glaucus*) showed slight stem smut. Early in 1942 a substantial amount of stem smut appeared in the same rows, while corresponding rows of Canada wild rye and crested wheatgrass were also affected. Attempts to secure infection by inoculating the seed or flowers failed.

Morphological comparisons by J. G. Harrar and D. M. Coe of numerous isolates of *Sclerotinia sclerotiorum* and *S. trifoliorum* from various hosts revealed no significant differences between isolates of the former from leguminous or non-leguminous plants, or between isolates from different parts of the State and country. No morphological differences were observed between *S. trifoliorum* isolates from eastern or western Washington or from other parts of the country. *S. trifoliorum* was found to produce most of its apothecia during autumn and early winter, while *S. sclerotiorum* produces its apothecia at any season. *S. sclerotiorum* was isolated from lucerne on several occasions, but most cases of lucerne crown rot gave *S. trifoliorum*, which was also isolated from red clover (*Trifolium pratense*), lentil, and *Lotus corniculatus*.

J. D. Menzies and J. G. Harrar state that in studies on witches' broom of lucerne [ibid., xix, p. 459], a serious problem in localized areas of Washington, graft transmission was conclusively demonstrated, being obtained by both root and top grafts. Transmission did not result from mechanical contact by rubbing, from juice inoculations, or from the use of dodder, and the evidence does not suggest that the disease is seed-borne. It occurs naturally on lucerne, and the same condition, or one closely similar, has been noted on red and white clovers (*Trifolium pratense* and *T. repens*). *Medicago lupulina* was artificially infected by grafting, and mild symptoms resulted, but no infected plants have been seen in the field.

Studies by L. Campbell on the running-out diseases of strawberries showed that in western Washington yellows [yellow edge] is the most important factor [ibid., xx, p. 348], the principal variety grown locally being Marshall, which is highly susceptible. Root rots [loc. cit.] are less important than yellows in the running-out of Marshall strawberries, but cause some loss, and are very serious on other varieties in some places.

L. K. Jones states that large plantings of the Cuthbert blackberry variety in western Washington do not show any green mosaic. Plantings of the Washington variety in 17 counties were free from mosaic, although this variety had been exposed to the disease in adjacent stock for two or three years. The varieties Indian Summer, Lloyd George, Marcy, Newburg, and Taylor have in the past been considered to be resistant to mosaic, but they were all observed to be affected.

Carnation bacterial wilt (*Phytomonas caryophylli*) [ibid., xxi, p. 325] was noted in only one greenhouse in the State. The disease is perpetuated from year to year in cuttings from affected plants and in soil from which diseased plants have been removed. Carnations in one greenhouse are still seriously affected by bacterial leaf spot (*P. woodsii*) [ibid., xiv, p. 365]; the disease was introduced into the State in cuttings in 1940. Thorough spraying with Burgundy mixture (4–6–50) and care in selecting cuttings have failed to eliminate the disease from three affected varieties.

Inoculation experiments demonstrated that the spotted wilt virus was quite damaging to one *Chrysanthemum* variety in one greenhouse. The virus appeared to have been carried by *Thrips tabaci* from affected cineraria plants [cf. ibid., xiv, p. 201]. Experimental evidence showed that the viruses causing cineraria streak and mosaic are often seed-borne, and that careful seed selection offers a practical means of control. Evidence was obtained that the cineraria streak virus is transmissible to tomato by mechanical inoculation.

Marked differences in susceptibility to carnation yellows [ibid., xx, p. 348] appeared in inoculation tests with 17 seedling varieties. Five new seedling varieties seem to be well adapted to commercial production, and two of them show strong resistance. Two viruses appear to be associated with the condition.

Principales enfermedades parasitarias que fueron objeto de consulta en el segundo semestre (Julio-Diciembre) de 1941. [The principal parasitic diseases which were the object of consultation during the second half (July to December) of 1941.]—*Bol. Sanid. veg. Santiago*, i, 2, pp. 52–55, 1941.

Included in this tabulated list of plant pathogens investigated by the phytopathological staff of the Chilean Ministry of Agriculture from July to December, 1941 [cf. *R.A.M.*, xxi, p. 443] may be mentioned *Bacterium* [*Xanthomonas*] *juglandis* on walnut, *Colletotrichum dianthi* on carnation, *Cycloconium oleaginum* on olive, *Diuporthe citri* and *Leptothyrium pomi* on orange, *Fusarium annuum* on chilli [ibid., xix, p. 676], *Melampsora bigelowii* on *Salix nigra* [ibid., xviii, p. 642], *Peronospora hyoscyami* on tobacco [ibid., xvi, p. 65], *Phytomonas* [*Bacterium*] *tumefaciens* on olive and quince, *Physalospora malorum* [*P. obtusa*] on apple, *Pseudopeziza medicaginis* on lucerne, *Puccinia sorghi* [*P. maydis*] on maize, *Sclerotinia fuckeliana* [*Botrytis cinerea*] and *Uncinula necator* on vine, *S. libertiana* [*S. sclerotiorum*] on onion, lemon, fig, and *Camellia japonica*, *S. minor* on *Lotus corniculatus*, *Sphaeria* [*Mycosphaerella*] *fragariae* on strawberry (*Fragaria chilensis*), *Tranzschelia* [*P.*] *pruni-spinosae* on peach, *Uromyces betae* on beet, and *Ustilago bromivora* on *Bromus unioloides*. Among the non-parasitic diseases listed separately on p. 56 of the *Boletin* are needle fusion of *Pinus insignis*, exanthema of citrus, and potassium deficiency [leaf scorch] of apple.

Braun (A. C.) & White (P. R.). **Bacteriological sterility of tissues derived from secondary crown-gall tumours.**—*Phytopathology*, xxxiii, 2, pp. 85–100, 2 figs., 1943.

In further studies on the bacteriological sterility of tissues derived from secondary crown-gall (*Phytomonas* [*Bacterium*] *tumefaciens*) tumours on sunflowers [*R.A.M.*, xxii, p. 12], involving over 2,000 tests of various kinds, the organism failed to develop under the most favourable nutritional and environmental conditions. Negative results were likewise obtained by the application of special methods appropriate to the isolation of small numbers of bacteria or of dormant phases, filterable or non-cultivable forms, or viruses. The implantation of such tumour-tissue cultures in sunflower and tomato gave rise to typical crown-gall tumours which again did not yield *Bact. tumefaciens* in response to the usual tests, while the use of the same material as an antigen in agglutination and complement-fixation experiments also disclosed no trace of the pathogen.

The evidence here presented is considered to offer unexceptionable grounds for the conclusion that the tumour-tissue cultures isolated from secondary excrescences are entirely free from *Bact. tumefaciens* or other identifiable tumour-stimulating agents. Such bacteria-free cells of crown-gall tumours show many essential features of true malignant animal cells, and thus represent a potential source of information on certain basic principles involved in the etiology of malignancy.

Braun (A. C.) & Laskaris (T.). **Tumor formation by attenuated crown-gall bacteria in the presence of growth-promoting substances.**—Abs. in *J. Bact.*, xlv, 2, p. 196, 1943.

An attenuated culture of *Phytomonas* [*Bacterium*] *tumefaciens* produced large tumours on tomato plants when supplemented with growth-promoting substances, either in synthetic or plant hormone form. Fragments of such artificially induced

tumours, introduced into healthy tomato plants, developed into typical large excrescences in four to five weeks. The neoplastic tissues have now been carried through five consecutive passages in tomato plants covering a period of six months. One clone of tumour tissue isolated was absolutely free from crown gall bacteria [see preceding abstract]. Fragments of this tissue grew rapidly into large tumours similar to those containing bacteria. The growth substances alone were shown to be incapable of inducing tumour formation in the host cells, this being apparently a function of the attenuated culture. The latter by itself, however, is unable to cause any further appreciable stimulation of the altered cells, which require activation by the growth substances to develop in the uncontrolled fashion characteristic of infection by a virulent crown-gall culture.

Baker (R. E. D.) & Crowdy (S. H.). **Studies in the witches' broom disease of Cacao caused by Marasmius perniciosus Stahel. Part 1. Introduction, symptoms, and etiology.**—*Mem. imp. Coll. trop. Agric., Trinidad*, 7, 28 pp., 18 figs., 10 graphs, 1943.

Cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxii, p. 163] is widespread in and probably indigenous to South America, where it occurs in Brazil, Bolivia, Peru, Colombia, Venezuela, Ecuador, Surinam, and British Guiana. It is also present in Trinidad and Tobago, these islands representing outlying portions of a vast zone of infection centred in the Amazon valley and including the greater part of the cacao-producing areas of South America.

Spread can take place only by means of the spores, which develop in sporophores on dry brooms. Only young, growing tissues are attacked. Both the vegetative shoots and the cushions may become infected, the symptoms produced being variable and confusing. The sort of broom formed depends on the type and age of the infected tissue and probably on the genetic constitution of the tree. A detailed study of sporophore formation in two localities showed that sporophores are never produced on green brooms, and occur on dry ones only after a definite period has elapsed. The duration of this period is of the greatest importance in the control of the disease, since it indicates how often the brooms should be removed annually to keep the disease in check. Normally, brooms become dry five or six weeks after their formation, though this period may last ten weeks. After drying, the average dormancy period before sporophore formation begins is five or six months, but this period is very variable and its length depends chiefly on climatic conditions. The extreme range was 10 to 66 weeks after the brooms had first been observed. Sporophore production, once started, continues (except at the height of the dry season) as long as the broom remains on the tree, or even, under special circumstances, after the broom has fallen to the ground, though after the end of the second year sporophore production becomes considerably reduced. After brooms have fallen from the tree they very seldom produce sporophores, and unless left in heaps, they soon disappear.

Not all brooms produce sporophores. In a dry area where observations were made about 70 per cent. produced sporophores, while in a wet one the figure was about 60 per cent. Large brooms produce many more sporophores than small ones. Chupon brooms and diseased pods are also not very productive of sporophores. Under natural conditions, many brooms remain on the trees for over a year and serve as a dangerous source of spores for a large part of this period. Scars left by fallen brooms behave like the small types of broom. Of 32 scars observed for nine months, 40·6 per cent. produced sporophores, the average number on each being 4·31, as compared with 4·67 for the smallest type of broom.

No positive correlation or precise relationship could be established between weekly rainfall and sporophore production (as gauged by the sporophore index, a figure obtained by dividing 100 × the total number of sporophores produced

during the week by the total number of brooms potentially able to produce sporophores), in spite of the fact that rainfall exercises a controlling influence on sporophore production. In general, sporophore production reaches a peak in the wet season, and is much reduced or altogether inhibited in most of the dry season. It continues at a fairly high rate into the beginning of the dry season. It does not resume full wet-season intensity until some weeks after the onset of the rains, except for a short burst at the oncoming of the wet season. An increase in rainfall generally causes increased sporophore production, but excessive rain may have a depressing effect. Short, dry periods followed by rain stimulate production.

Almost all the sporophores produced in March and April, two very dry months, are formed by brooms which have been producing sporophores for some months, and not by recently developed brooms. Also, no brooms formed during the two final months of the wet season will produce sporophores until after the following dry season, and it makes no difference to the subsequent sporophore production of a broom whether it develops in November or March or any intervening month. This accounts for the fact that brooms formed in November take longer to produce sporophores than those formed between April and August, most of which will have produced sporophores before the dry season checks their development.

No brooms formed in November have been seen to produce sporophores before the dry weather, but in the wet area a few of those produced in October generally do so. In the dry area, no sporophores are produced before the dry weather on brooms developing in October, unless the rains are unduly prolonged. This has an important bearing on control by broom removal, since if this has been thoroughly carried out in October, brooms subsequently formed cannot produce a sporophore before the next wet season, and consequently can safely be left until the main clearance in April.

From October to February, when sporophore production is at a maximum, most of the sporophores are produced on brooms formed in the preceding period of November to February; and as more than 80 per cent. of the annual total of brooms are produced during this period, sporophore production must be very great from October to February. It is to prevent this intense sporophore production, followed by a great development of brooms in January and February, that the routine removal of brooms in April and October is recommended. Brooms formed between March and June reach a high level of sporophore production in the wet season immediately following their formation, but only a few brooms are formed at this season, and they are unimportant from a practical point of view. Brooms formed between July and October may begin sporophore production during the same wet season, but do not attain maximum production until the following wet season. They are most dangerous at the beginning of the rains, before most of the January and February brooms have come into production, and are responsible for most of the infections set up at this time.

Spore deposition depends largely on temperature and generally occurs at night, over a temperature range extending from approximately 57° to 85° F. At 75° germination starts in two hours, and is 95 per cent. complete in four.

Inoculation experiments were conducted in 1941 and 1942 on seven-year-old seedling trees and three-year-old clonal material, using a spore suspension painted on to the trees or applied with an atomizer. Of 247 such inoculations, 61 (26 per cent.) were successful. Of 149 made after the onset of the dry season, only 6 (4 per cent.) were successful, while of 159 made in wet weather 55 (or 35 per cent.) were successful. Failures are attributed to the inoculation of non-susceptible tissues, failure of buds to flush, and unfavourable enviropmental conditions. A fresh spore suspension, young developing buds, and suitable climatic conditions (of a kind not easily reproduced in a greenhouse) are essential. An easy, successful inoculation technique has now been devised, which may prove valuable in testing

for resistance in future breeding work. Climatic conditions are probably more important than has hitherto been realized; on a night when 96 per cent. success was obtained rain fell gently for an hour after the inoculations had been made, and the two occasions when 48 and 50 per cent. successes were obtained both occurred during a very wet spell.

Dealing with control in relation to sporophore formation, the authors state that even a short period at a low relative humidity will destroy the viability of the spores. Apparently, all spores that have not germinated die within 24 hours. This is of considerable practical importance, as it means that infection can occur only so long as an active source of spores exists. There are no resting spores to consider. Unless a spore produces infection during the night it is discharged, it is very unlikely to do so. It is also safe to assume, for quarantine purposes, that material such as budwood will carry no viable spores 48 hours after removal from any source of contamination.

By far the most important factors influencing sporophore production are atmospheric humidity and rainfall. Even prolonged periods of saturation are not enough to initiate sporophore production: rainfall is essential. Visible sporophore initials will, however, complete their development in a saturated atmosphere.

The data obtained showed that a careful removal of brooms by the end of May would reduce the total number of sporophores present the next wet season by 75 to 80 per cent., and that if a second removal were made in October or November, sporophore formation would be almost completely eliminated. Brooms need only be thrown on the ground (not buried or burnt), and as long as they are not piled up in heaps, they will produce very few sporophores. The same holds good for diseased pods and shells. Further, it is very doubtful whether control is helped by removing very small brooms. All brooms over 4 in. long must, however, be removed; and those over 2 in. long should be cut away, if possible.

McLaughlin (J. H.) & Melhus (I. E.). **The response of some field crops on soil treated with chlorpicrin.**—*Iowa St. Coll. J. Sci.*, xvii, 2, pp. 213–220, 1943.

In experiments conducted on two experimental farms in Iowa, the soil was treated with chloropicrin (at the rate of 3 c.c. per injection at staggered 12 in. intervals equivalent to 480 lb. per acre [*R.A.M.*, xxii, p. 131]) in the autumn of 1940 and planted to oats, barley, wheat, rye, flax, cowpeas, lucerne, and sugar beets in the spring of 1941. The treatment had a general beneficial effect upon the germination, the growth of seedlings, and yields. Isolations from diseased root tissue of seedlings grown in the treated soil yield fewer *Pythium de Baryanum*, *P. graminicola*, and other fungi than did those from seedlings grown in untreated soil, and it is probable that the population of soil-borne pathogens was smaller in the treated than in untreated soil. Sugar beet responded strikingly to this decrease and showed 606 per cent. increase in dry weight. Barley showed 450 per cent. increase in yield.

Klages (A.). **Über moderne Saatbeizmittel.** [On modern seed disinfectants.]—*Z. angew. Chem.*, liv, p. 379, 1941. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 150, 1943.]

Far-reaching changes in the chemical structure of seed-grain disinfectants preceded the development of the 'universal' preparations in use to-day against the diseases of all four cereal crops and applicable in either dust or liquid form. The four fungicides of this type officially recognized in Germany in 1940 all contained complex mercury compounds. In the meanwhile, the mercury content, which in 1926 amounted to 16·5 per cent. in the best products, has been reduced, without loss of efficiency, to between 1·25 and 2 per cent. The phenol mercury compounds, e.g., in uspulun, have been replaced by more effective complexes of aliphatic and aromatic hydrocarbons of the type $Hg\langle^{R}_{X}$, in which R is

represented by an alkyl, oxyalkyl, or aryl, and X by a hydroxyl or a single or complex salt-forming anion, such as an acid residue. To the last-named group belong the phenols, dioxybenzols, and pyrocatechol. Both the fungicidal, mercury-containing, electropositive group and the negative acid residue permit of changes influencing surface activity, lipoid solubility, and physico-chemical and biological behaviour.

Holton (C. S.) & Johnson (A. G.). **Physiologic races in Urocystis tritici.**—*Phytopathology*, xxxiii, 2, pp. 169–171, 1943.

Apart from the discovery by Yu *et al.* that five races of wheat flag smut (*Urocystis tritici*) occur in China [*R.A.M.*, xvi, p. 305], little work has been done on physiologic specialization in this fungus [ibid., xxi, p. 328]. The writers' investigations in 1941–2 were carried out to determine whether the disease in widely separated areas of the United States is caused by one or more races of the smut. Seed-grain of over 100 winter and spring wheat varieties was inoculated with two collections of *U. tritici*, one from Washington and the other from greenhouse material originally obtained from Kansas, and planted in experiment station greenhouses in Washington, Virginia, and Maryland. It was apparent from the divergent reactions of the test varieties to the smut that two races were involved, that from Kansas being designated as 1 and the Washington collection as 2. For instance, the incidence of infection on Oro × Federation 38 and 40 was nil with race 1 and ranged from 59 to 86 and from 29 to 78 per cent., respectively, with 2. These crosses appear to possess the Oro type of reaction, whereas Oro × Federation 1 and 26, like the latter parent, are susceptible to both races.

Gorter (G. J. M. A.). **'Doodgaansiekte', Fusarium-blight or common root rot of Wheat.**—*Fmg S. Afr.*, xviii, 204, pp. 181–183, 2 figs., 1943.

The disease of wheat in the Bredasdorp and Caledon areas of South Africa which is known locally as 'doodgaansiekte' is caused chiefly by *Fusarium graminearum* [*Gibberella zeae*]. It is estimated that in years favourable to infection, some farms sustained losses of up to 30 per cent. of the yield as a result of attack. Injury is greatest in the ear stage. Affected plants show a yellow discoloration a few weeks before harvest time and die early. If any kernels are formed, they are few and shrivelled. The roots show dark brown, shrunken spots, or a uniform, light brown decay. Under moist conditions the base of the stem shows a pink discoloration, and the bottom internode (or the bottom two) are brown. Control consists in seed treatment with copper carbonate or with agrosan or ceresan, the planting of early varieties, and judicious fertilizing of the soil.

Cass-Smith (W. P.). **The control of loose or flying smut of Wheat (Ustilago tritici).**—*J. Dep. Agric. W. Aust.*, Ser. 2, xix, 4, pp. 236–239, 1 fig., 1942.

In a test made in 1942 for the control of loose smut of wheat (*Ustilago tritici*) seed-grain of the Merredin and Koorda varieties was pre-steeped in water to raise the temperature of the grain to 120° F. as rapidly as possible, then steeped in water at 120° for 95 minutes, and finally immersed in cold water and dried. All seed-grain was treated about six weeks before sowing with an organic mercury dust, to protect any that might have been mechanically injured by the hot-water treatment.

The treated Merredin seed-grain gave 70·5 per cent. germination and no smut, as against 78·6 per cent. germination and 2·1 per cent. smut for the untreated seed, while the corresponding figures for Koorda were (treated) 61·4 per cent. germination and no smut and (untreated) 80·3 per cent. germination and 1 per cent. smut. The depressed germination of the treated seed was partly due, it is thought, to shortage of cold water for the final immersion. During the growing period weaker

seedlings developed from the treated than from the untreated seed, but by flowering time the difference was much less marked.

No affected plants developed in the test plots from the treated seed of either variety, or in the bulk plots where the remainder of the treated seed was sown.

Pre-emergence damping-off of peas has been responsible for many complaints in the metropolitan and adjacent districts of Western Australia. Treatment of the seed with organic mercury and copper carbonate dusts increased germination in infested soil from a mean of 8 per cent. for four varieties to 25 and 53 per cent., respectively. It is recommended that where pre-emergence damping-off has caused poor stands, copper carbonate dust should be applied at the rate of 2 oz. per bush.

Flax rust (*Melampsora lini*) has proved a serious factor to the cultivation of linseed and to a lesser extent of fibre crops. Wild flax (*Linum marginale*) is said to be an important host of the disease. Collections of rusted plants are being made in all the Australian States for the identification of the physiologic races involved and for breeding purposes.

TEAKLE (L. J. H.). **Experiments with micro-elements for the growth of crops in Western Australia. VI. Further results from the use of copper-containing fertilizers in the Wheatbelt.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xix, 4, pp. 242–253, 2 figs., 1 map, 1942.

To obtain further information on the occurrence and cure of copper deficiency on wheat soils in Western Australia [cf. *R.A.M.*, xxii, p. 17], a number of experiments were carried out locally in 1941 with copper-containing fertilizers, and inquiries were also made of farmers who had tried such fertilizers. Some of the experiments gave beneficial results, but not others, and about one-third of the farmers who had used copper sulphate as a fertilizer reported satisfactory results.

The types of country likely to be acutely deficient in copper for cereal crops are detailed, and the opinion is expressed that the use of fertilizers containing copper will correct the deficiency. An annual application is not highly important if 5 to 10 lb. of copper sulphate per acre are used with the first dressing, as such applications have remained effective for several years.

NATTRASS (R. M.). **'Take all' disease of cereals (Ophiobolus graminis).**—*E. Afr. agric. J.*, viii, 3, pp. 133–135, 1 fig. (facing p. 136), 1943.

After stating that wheat take-all (*Ophiobolus graminis*) has long been present in Kenya [*R.A.M.*, xix, p. 76], where it has occasionally caused serious loss, the author briefly describes the symptoms of the disease and succinctly reviews recent investigations on the fungus. As the form attacking oats is not likely to be present in Kenya, it is thought that oats can safely be grown after an affected wheat or barley crop. Where the altitude allows of it, maize may safely be alternated with wheat. *Lolium temulentum*, which occurs locally on cultivated land, is affected, and may harbour the fungus.

In conclusion, it is stated that the condition is more likely to be troublesome on light than on heavy soil; a firm seed-bed is essential, the ploughing-under of resistant plant residues being undesirable; if the disease is known to be present, two wheat crops should not be taken in succession, particularly on light soils; grass weeds on fallows and among other crops should be kept down; and the organic content of the soil should be maintained, and superphosphate applied.

OORT (A. J. P.). **De vatbaarheid voor stuifbrand van in Nederland verbouwde of beproefde rassen van Tarwe en Gerst.** [The susceptibility to loose smut of the Wheat and Barley varieties cultivated or tested in Holland.]—*Meded. Landb-Hoogesch. Wageningen*, xliv, 8, 54 pp., 1940. [English summary. Abs. in *Z. PflKrankh.*, lii, 12, pp. 547–548, 1942.]

The reactions of wheat to *Ustilago tritici* and of barley to *U. nuda* were deter-

mined by means of an inoculation procedure devised by the author in comparison with spontaneous infection, the former method possessing various advantages besides that of inducing a high incidence of disease. It should be noted that fairly low temperatures during the early growth stages of the host tend to suppress loose smut infection, so that for testing purposes winter and summer varieties should be sown somewhat earlier and rather later, respectively, than the normal dates. A reasonably high proportion of the winter wheat varieties tested, comprising diverse types of differing origin, proved resistant to *U. tritici*, while the summer group also included a number of sorts capable of withstanding loose smut. On the other hand, none of the barley varieties used in the trials showed any noteworthy degree of resistance to *U. nuda*. It was confirmed that *U. tritici* is not communicable to barley or *U. nuda* to wheat. Strict specialization exists within both smuts, the races of which attacking the winter varieties of wheat and barley are physiologically and pathogenically distinct from those encountered on the summer crops. In the case of wheat there are numerous resistant varieties of which use can be made in breeding experiments, but no such possibility exists in connexion with barley, so that the development of resistance in the latter therefore presents difficulties.

JØRGENSEN (C. A.). **Symptoms of potash deficiency in cultivated agricultural plants and their use for the detection of a potash deficiency in the soil.**—*Tidsskr. Planteavl*, xliv, pp. 557–633, 1940. [Abs. in *Chem. Abstr.*, xxxvii. 6, p. 1552, 1943.]

In Denmark symptoms of potash deficiency in barley are expressed mainly in white speckling of the leaves, necrosis of portions of the foliar tissue of varying extent also affecting this crop, clover, and swedes, while oats show a discoloration of the entire plant. The whitish-yellow specks on barley are particularly valuable as indications of a potash shortage which can be corrected by top-dressing. The effects of potash deficiency were more noticeable on crops following oats, swedes, and *Scleranthus* grass than on those succeeding barley, fodder or sugar beets, and timothy [*Phleum pratense*]. Analysis of the leaf spots revealed a marked deficiency of potassium.

SCHARRER (K.). **Versuche über die Brauchbarkeit einer in der Norddeutschen Affinerie Hamburg anfallenden Kupferschlacke als Düngemittel.** [Experiments on the utilization as a fertilizer of a copper slag from the North German Refinery, Hamburg.]—*Forschungsdienst*, xiii, pp. 33–44, 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 148, 1943.]

The author reports the results of co-operative investigations undertaken by the Prussian Marsh Experiment Station, the Fodder Cultivation Institute, Kiel, the Oldenburg Agricultural Experiment Station, and the Phytopathological Institute of the University of Bonn, to determine the efficacy of the copper slag collected from the North German Sugar Refinery in the control of reclamation disease [of cereals, mainly oats, and other crops: *R.A.M.*, xx, p. 352; xxi, p. 134]. Although the product in question did not equal copper sulphate in its beneficial effects on the affected plants, it proved to be quite a useful remedy, used after intensive mechanical pulverization at a minimum dosage of 900 kg. per ha., in relatively mild cases of the disease, its value as a fertilizer being enhanced by its high lime content and numerous trace elements. Fears that the arsenic and lead contents of the slag would exert an adverse effect on the crops were not realized, while the assumption that the phosphoric acid in the soil would be fixed by its iron constituent likewise proved to be erroneous. The utility of the Hamburg slag for reclamation disease control is stated to be surpassed by other copper residues, e.g., that of a Hessian shale, which approximates to copper sulphate in its curative action.

Chapman (H. D.) & Brown (S. M.). **Potash in relation to Citrus nutrition.**—*Soil Sci.*, lv, 1, pp. 87–100, 4 figs., 1943.

This is an expanded, tabulated account of work which has already been noticed from another source [*R.A.M.*, xxii, p. 63].

Chapman (H. D.) & Brown (S. M.). **Some fungal infections of Citrus in relation to nutrition.**—*Soil Sci.*, liv, 4, pp. 303–312, 4 figs., 1942.

In connexion with their studies of citrus in sand and solution cultures at the Riverside Experiment Station, California, the writers have observed a number of cases of parasitic diseases induced by nutritional conditions, two of which are reported in some detail. Four-year-old Navel and Valencia orange trees on sour orange rootstock growing out of doors in solution cultures of high potassium–low calcium content (10·02 : 3·14 milliequivalents per l.) developed brown-rot gummosis, *Phytophthora parasitica* being isolated by L. J. Klotz both from the obviously diseased roots and from those in another series of tests with a more favourable potassium-calcium balance. The Navel orange fruits in the high potassium–low calcium series showed a certain amount of water spot [*R.A.M.*, xvii, p. 671] on the rinds and considerable infection by *Alternaria citri*.

In a similar outdoor solution-culture experiment with Navels on sour orange rootstocks, the roots of the plants supplied with medium- and high-phosphate levels (1·5 to 5 m.e. per l.) contracted severe infection by *Thielavia* [*Thielaviopsis*] *basicola*, which occurred only in a mild form in the low-phosphate (0·10 m.e.) series. In all these cultures the hydrogen-ion concentration had been maintained close to P_H 5: when it was adjusted to a more acid reaction (3·5), the growth of the fungus was arrested, and the new roots developing subsequent to this alteration remained healthy [cf. ibid., x, p. 762].

These observations may be of some practical significance in relation to citrus disorders in California, where the soils of many old orchards contain heavy accumulations of phosphate and potassium through the continuous use of manures and mixed fertilizers.

Mackie (J. R.). **Annual Report, Agricultural Department, Nigeria, 1941.**—10 pp., 1942. [Mimeographed.]

Remarkable improvement has followed the treatment of oil palms affected with 'yellowing disease' [cf. *R.A.M.*, xx, p. 7] in Nigeria with wood ash, a complete cure having resulted, apparently, in many cases. The method is not yet, however, recommended to growers.

Rogers (C. H.). **Cotton root rot studies with special reference to sclerotia, cover crops, rotations, tillage, seeding rates, soil fungicides and effects on seed quality.**—*Bull. Tex. agric. Exp. Sta.* 614, 45 pp., 12 figs., 1942.

This bulletin presents the results of experimental work on cotton root rot (*Phymatotrichum omnivorum*) [*R.A.M.*, xxii, p. 135] conducted at the Blackland Experiment Station, Temple, Texas, from 1931 to 1942. Viable sclerotia of the causal fungus were found in cultivated and uncultivated soil to a depth of 8 ft.; the largest numbers, reaching several millions per acre, occurred in the first 3 to 4 ft. of soil. Under the microscope, viable sclerotia were found to have a relatively thin epidermis of thick-walled cells and a dense cytoplasm in the homogeneous cells of the interior, whereas the non-viable sclerotia had a thicker epidermis and a less dense cytoplasm in the internal cells. In plots with crop rotations and green manuring the number of sclerotia was reduced in comparison with those continuously planted to cotton, but this reduction is considered insufficient to explain the partial control of root rot obtained by these practices. It is suggested that the beneficial

effect may be exercised on the active stage of the fungus in the soil or directly on the host plant.

The root-rot fungus was found to parasitize plants of *Hemerocallis* sp. and *Tradescantia* sp., causing the typical penetration and destruction of root tissues. Of the legumes found adaptable under local conditions for purposes of green manuring, *Sesbania* and guar (*Cyamopsis tetragonoloba*) proved to be highly resistant to root rot, and certain selections of Brabham and Iron cowpeas relatively so.

In crop-rotation trials, cotton-maize-oats rotation with cowpeas or sorghum ploughed under for green manuring in late summer after oats, resulted in an increase of 100 lb. per acre in the yield of lint cotton and a decrease by 20 to 30 per cent. in the amount of root rot, as compared with data from continuous cotton plots. Similarly, the yields of cotton following the ploughing-under of Hubam clover stubble (after harvesting the crop for hay or seed) was twice as large or larger than in continuous cotton plots, and the amount of root rot reduced from 70 to 15 or 20 per cent.

Subsoiling to depths of from 15 to 30 in. was found to give consistent reductions in the amount of root rot, but did not increase yields sufficiently to justify the expense entailed. Ploughing-under of cotton stalks immediately after picking, and while they are still green, reduced root rot and increased the yields of cotton; no additional benefit resulted from the supplementary treatment with 120 lb. nitrogen per acre.

In a three-year study, in which cotton seed was planted at rates of 2, 5, and 10 seeds per hill, in hills 18 in. apart, and the stands later thinned out to not more than two plants per hill in all plots, the lowest percentage of root rot and comparatively high yields were observed in plots with the fewest seeds per hill. Cotton plants killed early in the season by root rot were found to produce hardly any crop and their seed to have a lower oil and protein content and a lower viability than seed from plants which succumbed to root rot later in the growing season.

Soil treatment with crude oil, applied at a depth of 12 or 18 in. at rates of from 1,000 to 15,000 gals. per acre, considerably reduced root rot and increased cotton yields. In tests with various fungicides, a combination of copper sulphate, iron sulphate, and soil sulphur (2 oz. of each of the materials per cu. ft. of soil) was most effective in controlling root rot and chlorosis in roses.

Sylvén (N.). **Cordyceps militaris Fr. på Dasychira pudibunda (L.).** [*Cordyceps militaris* Fr. on *Dasychira pudibunda* (L.).]—*Bot. Notiser, 1942*, pp. 97–98, 1 fig., 1942. [Abs. in *Z. PflKrankh.*, lii, 12, pp. 546–547, 1942.]

In association with severe infestation by the Lymantriid, *Dasychira pudibunda*, in a beech forest in the Konga district of Scania (Sweden), *Cordyceps militaris* [*R.A.M.*, xviii, p. 507] was observed in profusion, several pupae being attacked over almost every square yard. The considerable practical value of the fungus for the destruction of the larvae and nymphs of several noxious moths is emphasized. The present find constitutes a new station of *C. militaris* for Sweden.

Ashburn (L. L.) & Emmons (C. W.). **Spontaneous coccidioidal granuloma in the lungs of wild rodents.**—*Arch. Path.*, xxxiv, 5, pp. 791–800, 3 figs., 1942.

Of 105 rodents trapped in the desert round San Carlos, Arizona, nine showed gross pulmonary lesions (granulomatous nodules), mostly situated in the lower lobes of the lungs, viz., seven pocket mice (*Perognathus*), one kangaroo rat (*Dipodomys*), and one ground squirrel (*Citellus*). Fungi were present in all the lesions, ranging from 4 to 50 μ in diameter, the larger forms (upwards of 20 μ), however, being uncommon. The cells were provided with doubly contoured walls and varying amounts of lightly basophilic, irregularly and finely vacuolated cytoplasm, containing in some cases small, fairly well-defined, deeply basophilic granules. Two of the nodules from two pocket mice harboured six fungal cells which had

reached the stage of maturity coinciding with the assumption of the reproductive functions of sporangia: they measured 23 to 50 μ in diameter and showed distinct endosporulation. The progressive cytoplasmic cleavage and the shape of the endospores were characteristic of the developing spherules of *Coccidioides immitis* [*R.A.M.*, xxi, p. 333] as observed in human and experimental infections. The endospores formed a peripheral layer below the doubly contoured wall and encircled a large central vacuole, which was absent, however, from one completely ripe sporangium entirely occupied by small spores. Besides these fungal elements, varying numbers of cells of slightly different appearance and staining reactions were found scattered through the lungs of all the above-mentioned animals except the kangaroo rat, and in eight of another 13 rodents examined which showed no granulomatous involvement. The relationship of these forms to those within the nodules and to the fungi isolated from the animals is still under investigation [see next abstract].

Emmons (C. W.) & Ashburn (L. L.). **The isolation of Haplosporangium parvum n. sp. and Coccidioides immitis from wild rodents. Their relationship to coccidioidomycosis.**—*Publ. Hlth Rep., Wash.*, lvii, 46, pp. 1715-1727, 4 pl., 1 fig., 1942.

Continuing their studies on the fungus accompanying *Coccidioides immitis* in the lungs of some desert wild rodents and occurring independently in others [see preceding abstract], the writers here describe it as a new species of *Haplosporangium* under the name of *H. parvum*. It is characterized on acid dextrose agar by a delicate, matted, white, later brownish mycelium, sparsely septate hyphae averaging about 1, rarely attaining 4 μ in diameter, slender conidiophores, either simple, 0·5 to 4 μ in length, or branched, 1·1 by 0·5 μ, and spherical or subspherical, minutely echinulate, subsequently smooth conidia, 3 to 3·5 μ in diameter, containing one or more hyaline bodies. In the host tissues the organism occurs in the shape of spherical, non-budding cells up to 14 μ in diameter, the species affected being *Perognathus baileyi*, *P. penicillatus*, and *P. intermedius*, *Dipodomys merriami*, *Citellus harrisi*, *Onychomys torridus*, and *Peromyscus eremicus* (92 specimens in all, exclusive of the nine mentioned in the previous paper, in which *Coccidioides immitis* was also present).

Evidence from skin tests on school-children suggests an antigenic relationship between the two fungi under discussion, while a genetic connexion is indicated by the circumstances of their isolation, their resemblance in the host tissues, and the results of laboratory studies. Possibly the relatively avirulent *H. parvum* may be a mutant of *C. immitis* arising under desert conditions or developing when the spores of the latter are inhaled by comparatively resistant animals. Should this supposition be verified, a hitherto unrecognized point of attachment between *C. immitis* and the Phycomycetes would be provided, while attention should also be drawn to some striking cultural affinities between *H. parvum*, *Blastomyces dermatitidis*, and *Histoplasma capsulatum* (Fungi Imperfecti).

Jenkins (Anna E.). **Additional records of Violet scab.**—*Phytopathology*, xxxiii, 2, pp. 168–169, 1943.

Violet scab (*Sphaceloma violae*) is now known to occur in South Africa, New South Wales [*R.A.M.*, xviii, p. 373], and the following States of the American Union: New York, Pennsylvania, New Jersey, Maryland, Virginia, South Carolina, Georgia, Florida, Alabama, District of Columbia, Massachusetts, Connecticut, North Carolina, Mississippi, and Texas, the species of *Viola* susceptible to the fungus including *V. jooi*, *V. priceana*, *V. vilmoriniana*, and *V. cucullata*.

Chilton (S. J. P.). **Variations in sporulation of different isolates of Colletotrichum destructivum.**—*Mycologia*, xxxv, 1, pp. 13–20, 2 figs., 1943.

The nature of the loss of sporulation commonly observed in *Colletotrichum*

destructivum was studied in 14 single-spore cultures of this fungus isolated from *Trifolium repens*, its var. *ladino*, *T. pratense*, and *T. hybridum* in Pennsylvania in 1938. Transfers from the original cultures, made after six weeks or more, often produced sectored growth in plates of agar and a white, fluffy mycelium in tubes. Single-spore cultures made from such sectors or fluffy patches differed from the original cultures, some producing more and others less spores than these. As many as 15 distinct variants were obtained from one original culture. The original cultures were found to retain their ability to sporulate and other cultural characteristics through ten successive single-spore generations. Transfers to sterilized host tissue and to the living host did not help poorly sporulating cultures to regain their ability to sporulate. Two variants were isolated from lesions of sterile red clover seedlings previously inoculated with a single-spore culture of the fungus. Conidia were predominantly uninucleate, only a few containing two nuclei. It is concluded from these data that the loss of sporulation in cultures of *C. destructivum* is due to the occurrence of poorly sporulating variants genetically different from the original type which they replace.

Loftus Hills (K.). **The reaction of varieties of Trifolium subterraneum to leaf rust (Uromyces trifolii (Hedw.) Lév.).**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 272–274, 1942.

During the late spring of 1941, 46 varieties of *Trifolium subterraneum* being grown experimentally at Moss Vale, New South Wales, developed a heavy epidemic of leaf rust (*Uromyces trifolii*), and observations were accordingly made on the amount of infection present in the various varieties. As seed of many of these varieties had been sown at Canberra, where a minor epidemic of leaf rust also occurred, notes on the infection present there were obtained, from one replication, using a very similar infection grading.

The results are tabulated, together with the leaf rust resistance for these varieties as estimated by Levy and Gorman (*N.Z. J. Agric.*, liv, pp. 82–94, 1937), and Radel's classification (*Tasm. J. Agric.*, N. S., vi, pp. 16–24, 1935), and do not in all instances agree. Thus, at Moss Vale, Tallarook was heavily infected, but at Canberra it was only slightly attacked, while Levy and Gorman and also Radel placed it in the resistant group. Both Dwalganup and Mulwala showed greater relative infection at Palmerston North in Levy and Gorman's tests than at Moss Vale or Canberra, while there was definite evidence that at Moss Vale Dwalganup was more susceptible than Mulwala. Bacchus Marsh was heavily attacked at Moss Vale but remained unaffected at Canberra, and showed only slight infection in the other workers' tests (at Palmerston North and in Tasmania). All four sets of figures, however, agree as to the high susceptibility of the Mt. Barker variety and the resistance of Wenigup. Mulwala and Second Northam also showed no infection at Moss Vale.

There seems to be no general correlation between relative maturity and resistance, though there is a possibility that the early varieties may owe some of their apparent immunity to the fact that their growth had all but ceased when the epidemic broke out. In some instances the Moss Vale data show significant differences in susceptibility between different lots of one and the same variety. Some of this variation may be due to differences in maturity, but, on the other hand, actual differences in resistance perhaps exist between different lines of one variety.

Apparent differences in susceptibility of a variety at different places may be due to one or more causes, i.e., different physiologic races of the fungus, different lines of the host varieties, interaction between infection conditions and varietal susceptibility, or differences in the relative stages of growth when the epidemics occurred. In spite of these variations, it is clear that reaction to leaf rust of

the known varieties of *T. subterraneum* varies from highly resistant to highly susceptible.

Shilo (Y. M.). **The molding of feeds and its prevention.**—*Nauch. Zap. ukr. sel.-khoz. Univ.*, i, pp. 179–192, 1940. [Russian. Abs. in *Chem. Abstr.*, xxxvii, 5, p. 1204, 1943.]

Analyses of the chemical compositions of lucerne hay and barley infected by *Aspergillus fumigatus* indicated losses of nutritive substances, amounting in the latter crop after 60 days at 37° C. to 29·3 and 86·6 per cent. for crude protein and non-nitrogenous extractable substances, respectively. The mould develops on fodders during storage at a relative humidity of 60 per cent. Extracts obtained by Bodin and Lenormand's method from fodders infected by *A. fumigatus*, *A. niger*, *A. glaucus*, and *A. nidulans* proved highly toxic to rabbits and rats, especially in the case of lucerne.

Dippenaar (B. J.). **The control of deficiency diseases in plants.**—*Fmg S. Afr.*, xviii, 204, pp. 189–194, 4 figs., 1943.

In the western Cape Province, South Africa, zinc deficiency has so far been found to affect only fruit trees, particularly plum, peach, and apple, in which it produces little leaf [*R.A.M.*, xx, p. 368]. Pear, apricot, and citrus are slightly affected. In addition to the usual symptoms, in, for example, severely affected peach trees, apparently normal leaves develop a yellow discoloration of the tissue between the veins before the end of the growing season. This is termed 'mottle leaf', and is very prevalent in citrus trees, in which little leaf is rather exceptional.

This disease causes the loss of more fruit trees in the winter-rainfall area than any other, fungal and bacterial troubles included. It also attacks a wider range of fruit trees than any other widely known disease.

Growers must exercise great care when applying lime. In normal times, when ammonium sulphate is available, the application of this form of nitrogen will, in the course of years, increase soil acidity, and make the zinc present more readily available to the trees. Affected peach, apricot, pear, and apple trees should be treated with zinc sprays as soon as they come into full leaf, i.e., in western Cape Province, peaches and pears should be sprayed in October and November, and apples in December. Winter spraying of these varieties was less effective than summer spraying, but with plums it was more effective than spring or summer spraying. Citrus trees should be sprayed in spring as soon as the new growth appears but before the blossoms open. For the winter spraying of plums 20 to 50 lb. zinc sulphate per 100 gals. of water are used; lime is essential in spring spraying to prevent leaf burn, and the formula recommended is 10 lb. zinc sulphate and 5 lb. best-quality slaked lime per 100 gals. water for peach, apricot, and citrus trees; 15 lb. zinc sulphate and 7½ lb. lime for apples and pears. These mixtures entail no risk of leaf burn in dry weather.

Manganese deficiency symptoms are generally referred to as mottle leaf [loc. cit.]. The usual symptoms are not noted on citrus trees. Leader shoots die back, but show no little leaf. Severely affected peach trees give very poor yields.

Locally, manganese deficiency is more prevalent than zinc deficiency, affecting numerous vegetables, fruit trees, and ornamental plants [ibid., xxi, p. 467]. Plants (e.g., peach and citrus) sometimes show signs of lack of both zinc and manganese, and require to be treated for both conditions.

Thorough tests have shown that the following treatments against manganese deficiency can be recommended. Peach, apricot, plum, apple, and citrus must be sprayed with 2½ lb. commercial manganese sulphate per 100 gals. water, directly they come into full leaf and show symptoms of the trouble. Severely affected plums may require a second spray application four to six weeks later. Peach trees that

bear poorly as a result of manganese deficiency must receive an extra winter spray about six to eight weeks before blossoming, 10 to 15 lb. manganese sulphate per 100 gals. water being used. The weaker solution is used for vegetable crops, which should be given two or three applications at intervals of 14 days to three weeks. Potatoes twice sprayed with this yielded 115·75 lb., as against 21·25 lb. for the untreated controls, while beans [*Phaseolus vulgaris*] sprayed three times with a ¼ per cent. manganese sulphate solution yielded 7,184·5 gm. (dry weight), as against 1,939·5 gm. for the untreated controls. If stable manure is applied to vegetable soils deficient in manganese, the results are at least as good as those obtained where only fertilizers are applied and the plants sprayed with manganese. Seed beans and potato tubers grown in manganese-deficient soil will give symptoms even if planted in normal soil, and should be soaked in a ¼ per cent. manganese solution for four to six hours immediately before planting.

Symptoms of both zinc and manganese deficiency were removed from orchard trees by spraying with 10 lb. zinc sulphate, 5 lb. manganese sulphate, and 7½ lb. slaked lime per 100 gals. water.

A zinc-lime mixture, as recommended for early summer spraying, gave excellent results against leaf rust [*Puccinia pruni-spinosae*] of apricots and peaches, while a manganese-lime mixture was ineffective. On mandarin trees, however, zinc-lime or zinc-manganese-lime was much less effective than Bordeaux mixture against leaf and fruit spot due to *Macrosporium* sp.

Spraying schedules, 1942.—*Proc. N.Y. St. agric. Soc., 1942*, pp. 361–382, [1942].

Spraying schedules drawn up by the Agricultural Experiment Stations at Geneva and Ithaca, New York, are given for apples, pears, cherries, peaches, plums, quinces, and vines.

Stoddard (E. M.) & Heuberger (J. W.). **A simple rapid method of field testing fungicides on Apples.**—Abs. in *Phytopathology*, xxxiii, 1, p. 13, 1943.

The writers' method of testing fungicides on apple trees involves the use of young standards, planted 10 by 10 ft. (435 to the acre), thereby economizing in land, time, and labour. By this arrangement, spraying operations can be carried out with hand equipment and a number of preparations tested simultaneously, while data on control, injury, dosage, timing, or other points of interest are more easily obtainable than on large trees, and replication of plots is easily arranged. The inoculum, e.g., overwintered leaves infected by scab [*Venturia inaequalis*], can be uniformly distributed with a corresponding regularity in the incidence of attack. Data collected over a protracted period reveal a direct correlation between scab control on the foliage and on the fruit, so that the test materials are rated in the same order in respect of both organs. However, if fruit is expressly required for the purposes of an experiment, dwarf trees may be substituted for standards. This method would be similarly applicable to other foliar diseases of fruit trees, such as cherry leaf spot [*Coccomyces hiemalis*], *Bacterium* [*Xanthomonas*] *pruni* on peach, and cedar rust of apple [*Gymnosporangium juniperi-virginianae*].

Keitt (G. W.) & Moore (J. D.). **Experiments with eradicant and protectant sprays for Apple scab control in 1942.**—Abs. in *Phytopathology*, xxxiii, 1, p. 6, 1943.

The 'floor' of 40 acres on one side of a 60-acre apple orchard [in Wisconsin] was treated against scab [*Venturia inaequalis*] at bud-break with elgetol [*R.A.M.*, xxii, p. 144] at a strength of 0·5 per cent. and a dosage of 600 gals. per acre. Various protectant spray programmes were tested on randomized, replicated, single-tree McIntosh plots repeated in blocks I (ground-treated, more remote from non-ground-treated), II (ground-treated, intermediate), III (non-ground-treated) in all of which

some of the applications (usually numbering eight, three before and five after bloom) were unavoidably poorly timed, and IV, situated essentially as I but treated at the proper time. In blocks I to III the lime-sulphur spray 20 days after petal-fall was omitted. The disease occurred in a very severe form during the period covered by the trials. Spore discharge studies showed that ground treatment reduced ascospore inoculum by 99 per cent. Counts made a fortnight after petal-fall indicated that unsprayed trees in block I bore 87 per cent. fewer lesions than those in III. In ground-treated block I the percentage of infected fruits at harvest ranged from 11 for lime-sulphur to 19 for kolofog (after bloom, following lime-sulphur), while in non-ground-treated III the corresponding incidence was from 26 to 77 per cent. The well-timed lime-sulphur schedule in ground-treated IV permitted the development of only 2 per cent. scabbed fruit.

Shay (J. R.). **Genetic studies of certain mutant characters in Venturia inaequalis.**—Abs. in *Phytopathology*, xxxiii, 1, p. 11, 1943.

Several cultural mutants of *Venturia inaequalis* [*R.A.M.*, xxi, p. 208] were found to carry factors for partial or entire ascopore abortion, the former represented by the development of uni- or bicellular, misshapen, colourless, sometimes viable spore-like structures, and the latter by a complete absence of spore differentiation. Three mutants arising as white or pinkish-white sectors in culture transmitted factors for ascospore abortion. In 114 asci studied from a cross involving one such sector, white (W), normal (w), the four aborted ascospores of any ascus, when viable, uniformly gave rise to white cultures, whereas those produced by the four normal ascopores were normal, indicating that ascospore abortion and white colour result from the same mutation. White (W) was found to be closely associated in the same chromosome arm with another mutant of a tan (T) colour, which produced eight-spored asci in matings with normal (t). Another mutant, non-conidial (Nc), was located in relation to the centromere, but is probably not linked with tan. The sex factor appears to be situated at a considerable distance from the centromere, and there is thought to be no linkage between it and the white factor.

Van De Pol (P. H.). **Onderzoek naar het beste tijdstip der voorjaarsbespuiting tegen Appel- en Perenschurft (Venturia inaequalis (Cke) Wint. en Venturia pirina Ad.).** [An investigation on the most effective date for the spring treatment against Apple and Pear scab (*Venturia inaequalis* [Cke] Wint. and *Venturia pirina* Ad.).]—*Tijdschr. PlZiekt.*, xlvii, pp. 197–230, 1941. [Abs. in *Z. PflKrankh.*, liii, 1–3, pp. 149–150, 1943.]

In the spring of 1941, overwintered stromata of apple and pear scab (*Venturia inaequalis* and *V. pirina*), especially the latter, with mature conidia, were detected on inadequately sprayed trees even before the appearance of the first ascospores, but they were of comparatively slight importance in the establishment of primary outbreaks of the diseases. The stage of bud development is not considered to afford a suitable basis for the determination of the correct spraying date. By an adaptation of Speyer's method for the calculation of egg maturation in *Psylla mali*, the author computed that at Wageningen the first perithecia ripen when the sum-total of the temperatures prevailing from 7th February onwards reaches 285 to 289° [C.]. By this means it is possible to reckon the date by which the preliminary spring treatment should be given, while the period of ascospore discharge can be predicted from the appearance of the first free ascospores on the perithecia-bearing fragments of leaf tissue wetted daily in the laboratory. Practical applications of these principles were successfully made in various parts of Holland, and it is expected that the determination of correct spraying dates will lead to a substantial reduction in the annual losses from apple and pear scab, which are estimated at 15 per cent. of the crops, corresponding to a monetary value of Fl. 4,500,000.

CUMMINGS (M. B.) & DUNNING (R. G.). **Bitter pit of Apple. I. In orchard and in storage.**—*Bull. Vt agric. exp. Sta.* 467, 30 pp., 5 pl., 1940. [Received April, 1943.]

The first instalment of the authors' studies on bitter pit of apple briefly reviews the history and literature of the disease, describes observations, and presents twelve years' data obtained in the Experiment Station orchard and elsewhere in Vermont, and discusses the development of the disorder in storage at different temperatures, based on the results of three years' tests. The first record of bitter pit in Germany dates from 1869, since when it has been found in most of the apple-growing regions of the world, having been detected in Vermont from 1891 onwards. The etiology of the disease is still obscure, either an unbalanced nutritional condition, an irregular water supply, or both being possible causes, while the problem of control likewise remains unsolved.

Only four or five of the 40 varieties cultivated at the Experiment Station suffer severely from bitter pit, Arctic, Baldwin, Northern Spy, and Shiawassee being the most susceptible, but some half-dozen others have been found to develop the trouble to a limited extent in various parts of the State. A striking feature of bitter pit is its erratic occurrence, a tree showing virtual freedom from the disease in one year being heavily pitted in the next. Again, trees of the same variety in close proximity may develop extensive pitting at harvest and little in storage or vice versa. The condition is much more troublesome at harvest time in some seasons than in others, injury having been slight in 1931, for instance, and severe in 1936. These discrepancies may have been due to the differences in the rainfall distribution in the two years: in the former, after a wet June a dry spell supervened until mid-September, while in the latter, the rainfall was mainly concentrated in the late summer. In 1936 the average incidence of pitting in nine Arctics in the orchard was 38·8 per cent. and in storage from 18th September to the following 26th January 74·8, the corresponding figures for harvest, 1937, and storage from October to the following January being 1·6 and 18·2 per cent., respectively, and for harvest, 1938, and 10th January, 1939 (after storage since 18th November), 2·6 and 39·3 per cent., respectively.

Bitter pit develops most rapidly during the first two or three months of storage, its progress usually being arrested after midwinter, so that the healthy fruit can be separated from the diseased and sold.

Fruit from the 1937 crops of nine Arctics (1,207) and eight Spys (601), passed as perfect in January, 1938, were held in cold storage until mid-April, when the apples of the former variety were still in sound condition, whereas 2 per cent. bitter pit was detected in the fruit from three of the Spys and 5 per cent. in the lot from another tree of the same variety.

LEWIS (F. H.). **Is there danger of reducing the set of fruit by blossom-time sprays or dusts for control of scab, rust, or fire-blight?**—*Proc. N.Y. St. agric. Soc., 1942*, pp. 15–24, [1942].

Experiments carried out in New York State from 1939 to 1941, inclusive on 12- to 20-year old apple trees, to determine whether spraying or dusting against scab [*Venturia inaequalis*], rust [*Gymnosporangium* spp.], or fire-blight [*Erwinia amylovora*] during bloom exercised a deleterious effect on fruit set are described.

In 1939, a single sulphur dust application of 1 or 2 lb. per tree to McIntosh apples when 25 to 30, 50 to 60, 75 to 80, and one day after 75 to 80 per cent. of the flowers had opened gave, respectively, 12·4, 11·4, 11·4, and 17 fruits per 100 flower clusters in August, as against 18·1 for the untreated control. Trees of the same variety dusted 0, 1, 2, 3, and 7 times showed, respectively, 20·8, 17, 10·2, 9·3, and 9·1 fruits per 100 flower clusters in August. Pollination conditions were poor in this orchard.

In another, of the same variety, where these conditions were good, the trees were given a single application of 4 gals. per tree lime-sulphur (1–80) and flotation sulphur paste (6·5 [lb. per 100 gals.]) during full bloom. These treatments gave, respectively, 31 and 38 fruits per 100 flower clusters in August, as against 47 for the untreated control.

Similar results were obtained in further experiments [which are described] in 1940 and 1941, and it is concluded that spraying or dusting apple trees during bloom with the materials used in the experiments cited will reduce fruit set in many cases. Lime-sulphur appeared to cause the heaviest and sulphur the least injury.

Before deciding to apply bloom treatment, growers should first make sure that it is necessary. Apple fireblight [ibid., xxi, p. 530] can be partially controlled by the application of Bordeaux mixture or copper-lime dust during bloom. In those orchards where infection has been destructive, the possible reduction in fruit set and the danger of fruit russeting are less important than the disease, and bloom applications are probably justified. Where, however, infection has not been serious, bloom treatment may cause heavier loss than the disease.

HILDEBRAND (E. M.) & PALMITER (D. H.). **How to prevent destruction of New York State Peach orchards by the new yellow-red virus disease.**—*Proc. N.Y. St. agric. Soc., 1942*, pp. 34–40, [1942].

After referring to the early spread of 'X' disease or yellow-red virosis of peaches in New York State [*R.A.M.*, xx, p. 310; xxi, p. 147], the author points out that the steps taken to ensure that all new peach plantings were properly isolated from chokecherries [*Prunus virginiana*] have resulted in not one case of the disease being found in nursery peach trees in the whole State.

There can be no doubt that the disease is spread by some insect, which feeds on chokecherries. The disease spreads to peaches only when affected chokecherries are within a distance of about 200 ft. The usual sequence of events is a diseased chokecherry at the edge of a peach orchard one year, and diseased peaches the next. In the eastern areas of the United States, 'X' disease always spreads from chokecherry to peach, no case of spread from peach to peach having been found. If affected chokecherries are removed 200 ft. or more from an orchard, further spread between peach trees ceases. The western form of the trouble [ibid., xxii, p. 32] does, however, spread from peach to peach.

Growers starting new orchards should plant disease-free trees at a distance of 500 ft. or more from chokecherries, and if possible remote from all other wild species of *Prunus*. Where orchards in production are bordered by chokecherries, these must be killed or otherwise disposed of. Peach trees become worthless three years after infection, and can then be removed.

After many years' tests with chemical eradicants the best results in chokecherry removal were given by a spray consisting of $\frac{3}{4}$ lb. sodium chlorate in 1 gal. water. A single application in June is all that is required. Very good results have also been obtained with ammonium sulfamate, used at the same concentration, which has the advantage of not being inflammable. With shrubs up to 4 ft. tall, 1 gal. of either mixture will cover an area of about 100 sq. ft. Taller shrubs require additional spray up to 2 gals. for the same area. Cutting off the tops of the chokecherries is inadvisable as these herbicides act more effectively on woody than on succulent growth.

The risk of introducing the disease in propagating budwood or root stocks can be eliminated by exposure in a water bath to a temperature of 122° F. for six to ten minutes, which inactivates the virus. Experiments have confirmed Stoddard's finding that nectarine, almond, wild Bessey cherry [*P. besseyi*], and wild Hortulana plum [*P. hortulana*] are susceptible [ibid., xxi, p. 28], and will, it is expected, add other plants to the list of suscepts.